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METALS and ALLOYS

The Magazine of Metallurgical Engineering

PRODUCTION • FABRICATION • TREATMENT • APPLICATION

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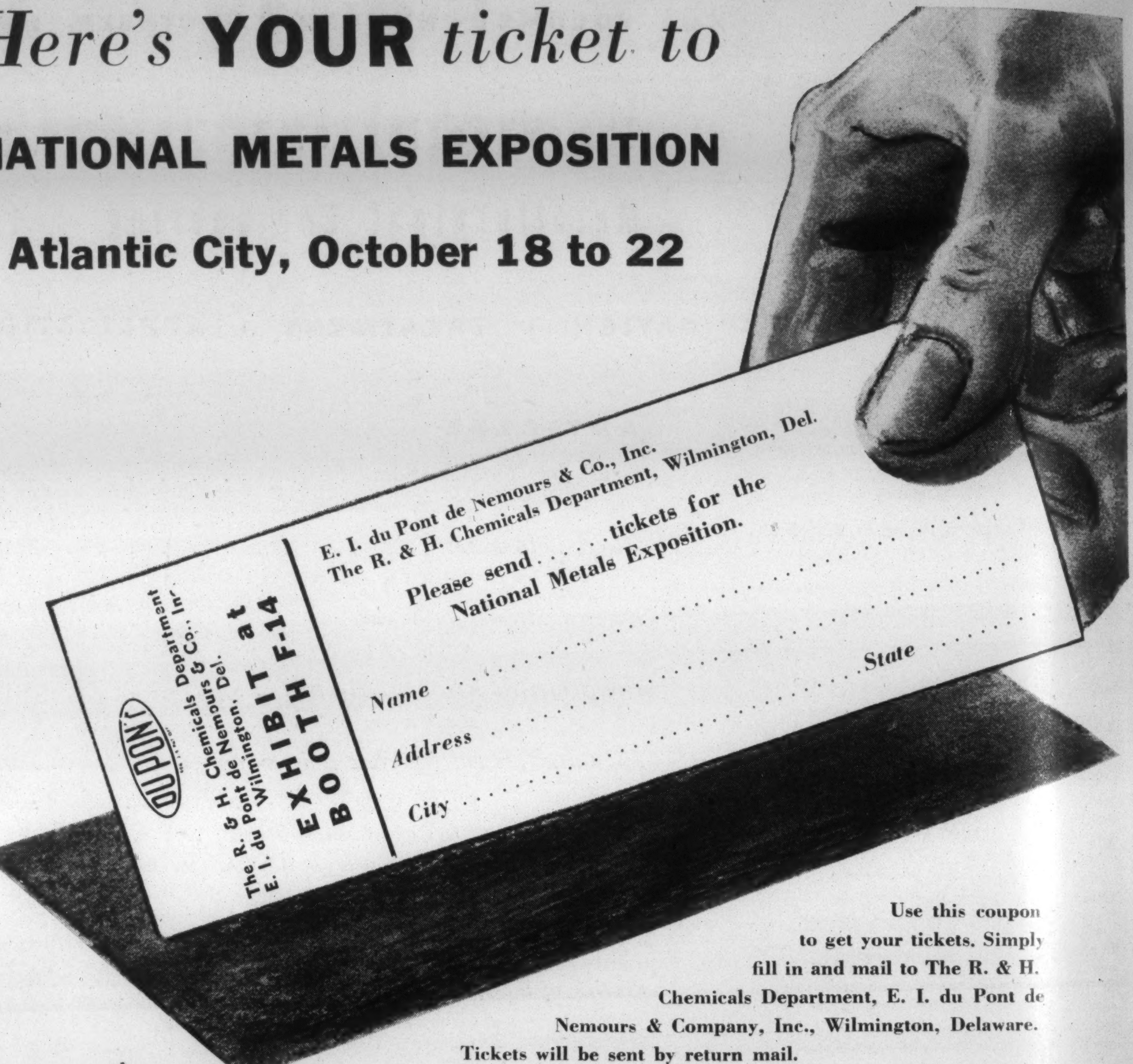

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R. & H. CHEMICALS AND PROCESSES

For Modern Metal Finishing

Highlights

WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF

Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.

Metallic Vitamins

Jeffries (page MA 637 L 3) aptly calls special addition elements used in improving castings or forming minor elements in alloys, "Metallic Vitamins."—B.W.G.

German Buckles of an Al-Mg-Si Alloy

As an example of the successful substitution of readily available metals for imported metals in Germany, Fischer (page MA 637 R 3) shows that wearing apparel accessories, such as buckles, that used to be made from nickel silver can be advantageously made from an Al-Mg-Si alloy.—B.W.G.

More Radium from Canada

In line with the times, the production of Canadian radium is being greatly increased (pages MA 638 R 2 and 639 L 4), not to a competitive point with the pig iron tonnage but to 5 or 6 grams per month. Even with present reduced prices for Ra and Ur, this involves handling several million dollars' worth per year.—B.W.G.

Increased Demand for Steel Castings

Corbet (page MA 638 R 3) considers that a shortage of skilled labor and high wages in the metal working industry is causing an increased demand for steel castings, where they can be used. It's an ill wind that blows no good.—B.W.G.

Measuring Thickness of Oxide Films

Thickness of oxide films on iron were measured by Miley (page MA 625 L 2) by the current necessary to reduce the films cathodically. Interference colors appearing on heating iron above 200 deg. C. are not the result of heavier coatings, as one might suppose, since the same thickness below 200 deg. does not give a color. The colored or elevated temperature oxide is believed to have a hexagonal structure, that at room temperature to be cubic.—B.W.G.

Precipitation Hardening of Alloys

Precipitation hardening of alloys can be accurately and conveniently studied by means of magnetic susceptibility measurements, according to Auer (page MA 625 R 2). Quantitative measurements between 0 and 600 deg. C. aid in determining solubility lines in phase diagrams, the composition of precipitated compounds, and in following atomic changes prior to actual precipitation.—B.W.G.

Internal Strain

The presence of very small particles in steel has been the subject of very intensive study during recent years. The mechanism of their effect on physical properties that is now advanced by Kinzel (page MA 632 L 2) is that a state of internal strain is produced by the particles in the metal matrix. On lowering the temperature a differential contraction between the particles and the matrix produces hoop tension in the matrix around the particle and thereby effectively prevents deformation. This idea is also extended to include intergranular corrosion, such as occurs in regular 18-8, the greater susceptibility to corrosion of the locally strained carbide areas rather than the impoverishment of chromium at the grain boundaries being responsible for the resultant intergranular attack. The idea is worth careful consideration.—V.V.K.

Dissociation Pressures of Metal Oxides

A. N. Volskii and Ya. Ya. Slobodskoi (page MA 605 R 3) have been checking up on some of the dissociation pressures of metal oxides in molten alloys.—B.W.G.

Depositing Three Metals Simultaneously

Simultaneous electrolytic deposition of three different metals to form a ternary alloy coating of desired composition is still sufficiently uncommon to deserve attention. Faust (page MA 622 R 7) does it with Cu, Ni and Zn from a cyanide bath. Difficulties of control increase at an alarming rate as the number of metals being simultaneously deposited increase. Salts for use in depositing a ternary alloy of Cu, Zn and Sn are being commercially advertised, however.—B.W.G.

Beautifying Metals with Colored Finishes

The importance of beautifying metals by giving finished articles a colored surface is gaining increased recognition. A description of the Stareck process (page MA 622 R 7) describes means of coloration by electrolytic means; Thompson (page MA 623 L 9) describes chemical methods.—B.W.G.

More About Tension Impact Tests

More information on tension-impact tests is given by Jenks (page MA 624 L 8), as well as reasons for unsatisfactory results in making tests by notch-impact.—B.W.G.

Russian Pig Iron for Japan

In commenting on the heavy exports of pig iron in 1936 from Russia to Japan (page MA 639 L 1), the reviewer says, "As Japan becomes more self sufficient, it is expected that the Russian production can be used for home consumption." Now isn't that an example for a good neighbor policy! However, for the sake of accuracy it must be admitted that only about 5 per cent of the total production was exported.—B.W.G.

Making Bronze Castings Years Ago

Foundrymen of today sometimes think they have troubles in making certain bronze castings but considering facilities available the old Chinese and Japanese bronze workers really had worries. The Chinese were casting bronze back in 1766 B.C., according to Read (page MA 639 L 10). Chaplet (page MA 639 L 8) says the Japanese used Pb and sometimes Ag in their bronzes, and 1200 years ago made a cast statue requiring about 1,000,000 lbs. of bronze.—B.W.G.

Strain Hardening by Machining

The fact that machining a metal induces cold working effects below the surface is common knowledge, but it is something new to know the relative cold working effect of different types of machining. Möller and Roth (page MA 610 R 7) find that roughing, drilling, etc., cold work steel samples twice as far below the surface as do grinding, polishing, etc.—F.P.P.

Corrosion Investigations

Current theories and methods of investigating corrosion are discussed in a 7-paper symposium in *Korrosion u. Metallschutz* (page MA 633 L 1).—F.P.P.

Al vs. Ag for Telescope Mirrors

According to Grotrian (page MA 637 R 6) condensed coatings of Al make better reflectors than Ag, in visible light ranges, because of their longevity. Al has higher reflectivity in the ultra-violet, but Ag is superior in the infra-red regions.—F.P.P.

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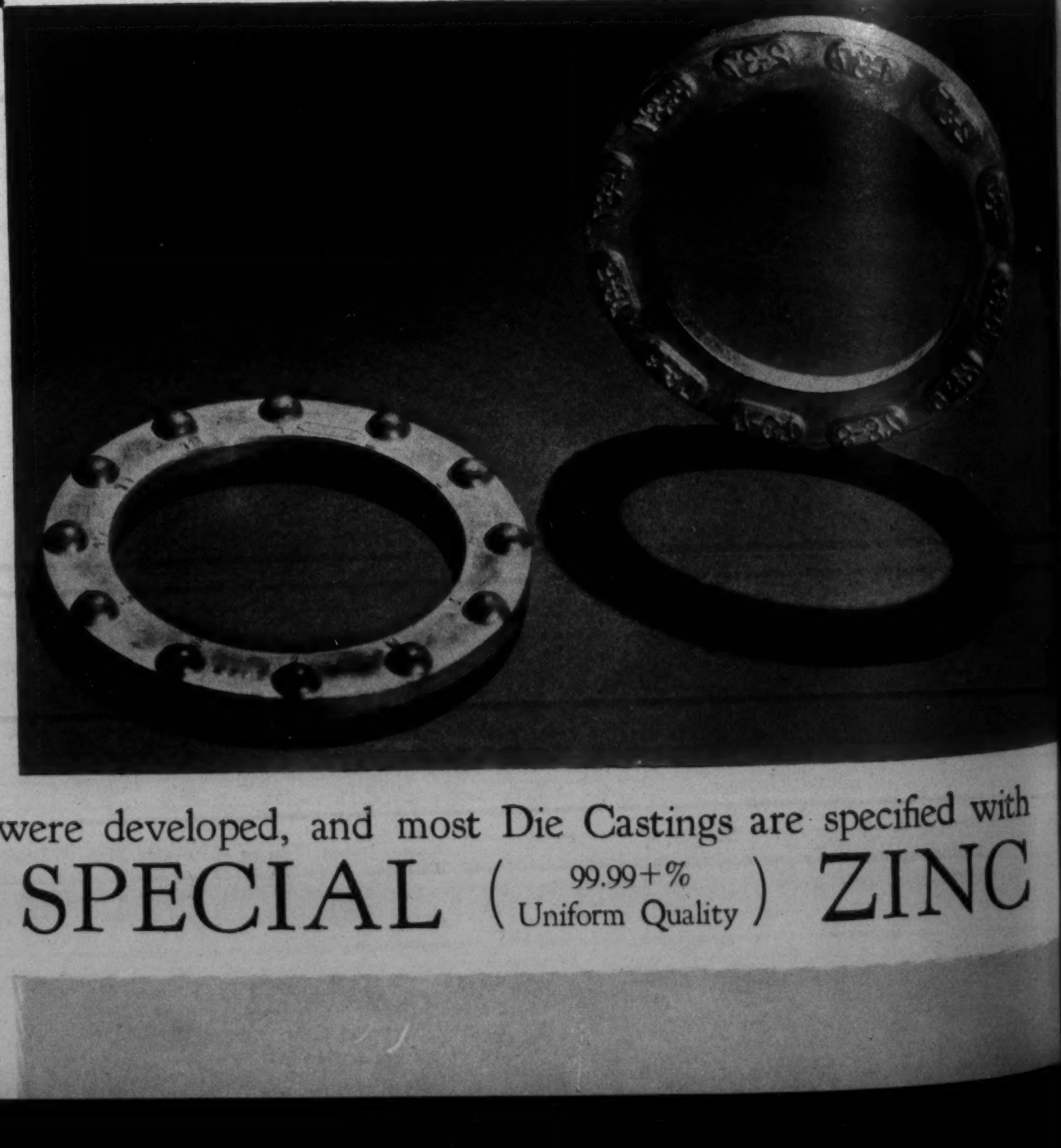

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EDITORIAL

The 40-Hr. Week

We recently read a comment by some philosopher, whose name escapes us, so we cannot give credit, to the effect that it takes the average man an average day's labor to make a living. Only those who do two men's work get ahead.

Mere time isn't the only factor, for one planned and effective hour is worth two dawdling hours, but even so a "working day" means different things to different people. If one shakes off his duties at 5 p.m. as a dog shakes water from his coat, even though he may show a dog-like devotion during working hours, he is likely to be too busy to do any constructive thinking in those hours, and the result is that he spends his life doing what someone else tells him to do.

If the philosophy of the 40 hr. week is extended to its logical limit and accepted by the rank and file, there will be an opportunity for the few who don't accept it, and carry their job on their minds nights and Sundays.

We wonder how far Earl Smith and the others like him would have gotten had they been imbued with the idea that 40 hours is a week's work!—H. W. G.

Molybdenum Forges Ahead

A statistical demonstration of the well-known fact that the use of molybdenum is continually on the increase is afforded by U. S. Government data on the American molybdenum industry for 1936. These data show the following significant facts for last year as compared with the two previous years:

	1934	1935	1936
Mo in concentrates, lbs.	9,362,000	11,512,000	17,186,000
Ore, net tons	1,339,000	1,384,000	2,269,000
Concentrates, net tons	9,119	11,786	17,686
Shipments (Mo contained), lbs.	9,377,000	10,892,000	17,959,000

Viewed from any angle these data show that a marked increase in molybdenum was recorded in 1936. Production of molybdenum last year was 49 per cent in excess of that for 1935 and 83.5 per cent over that of 1934.

More and more molybdenum is recognized and used by metallurgists, either as an alloying element alone or in combination with other alloying elements in steels because of its varied beneficial effects in attaining the physical and other properties desired.—E. F. C.

Retrospection

It is the current fashion to "view with alarm" the present attitude of the government towards industry and the effect of that attitude on business and its prospects for the future. However serious the condition may be, there should be some solace in the knowledge that this is not the first time in our history that government and industry regarded each other with something less than kindliness and that industry, nevertheless, survived the experience and continued to grow.

Twenty-five years ago the government was engaged in a trust-busting campaign that rested about as heavily on the hearts of business men as do the New Deal's existing and threatened industrial control measures today. There are other striking similarities between the two periods. The country was emerging from a depression and the trade papers of 1912 included frequent statements to the effect that the "general industrial boom continues in apparent disregard of adverse political conditions." Labor was in the throes of organization and the controversy over the "disastrous possibilities" in the 8-hr. day was still raging. And yet, both the capital-splitting politicians and the prophets of destruction among industrialists were subsequently confounded. The social and economic justification for great affiliated enterprises is unquestioned today, just as is the fact that the introduction of the 8-hr. day was a boon to industry as well as to its employees.

Somehow, time seems to dispel fallacy and elevate truth, and even modern business may survive the harassing to which it is now being subjected.—F. P. P.

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CURRENT Metallurgical Abstracts

A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD

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CLASSIFICATIONS

1. ORE CONCENTRATION

Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).

2. ORE REDUCTION

Non-Ferrous (2a), Ferrous (2b).

3. MELTING, REFINING AND CASTING

Non-Ferrous (3a,) Ferrous (3b).

4. WORKING

Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching Drawing & Stamping (4c), Machining (4d).

5. HEAT TREATMENT

Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).

6. FURNACES, REFRACTORIES AND FUELS

7. JOINING

Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).

8. FINISHING

Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (8f).

9. TESTING

Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).

10. METALLOGRAPHY

11. PROPERTIES OF METALS AND ALLOYS

Non-Ferrous (11a), Ferrous (11b).

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

13. CORROSION AND WEAR

14. APPLICATION OF METALS AND ALLOYS

Non-Ferrous (14a), Ferrous (14b).

15. GENERAL

Economic (15a), Historical (15b).

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1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

Production and Market Control. (Effects on Technical Developments) O. W. ROSKILL. *Metal Ind.*, London, Vol. 60, Jan. 15, 1937, pp. 71-76. Reviews the operation of agreements and restriction schemes for control of production and their effects upon the practice and output of individual smelting companies. RWB (1)

Advances in Copper Metallurgy (Increased Importance of Empire Producers) H. J. MILLER. *Metal Ind.*, London, Vol. 50, Jan. 15, 1937, pp. 77-82. General review. Covers the developments at the principal British mines in the last few years. 21 references. RWB (1)

1a. Crushing, Grinding & Plant Handling

Comparison of Low Versus High Discharge for Ball Mills. E. L. LONGMORE & THE HOLLINGER MILL STAFF. *Bul. Inst. Mining Met.*, No. 392, May 1937, pp. 23-30. Addendum by authors and discussion. See *Metals and Alloys*, Vol. 8, Aug. 1937, p. MA 474L/5. AHE (1a)

1c. Flotation

Chemistry at Trail and Kimberley—Metal and Chemical Production on the Largest Scale in Canada as Illustrated by the Process Operations of the Consolidated Mining & Smelting Co. of Canada, Ltd. G. L. WHITE (Staff) *Can. Chem. Met.*, Vol. 21, May 1937, pp. 165-169. Operations at the Sullivan mine are described. Selective flotation has reached a high standard. WHB (1c)

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2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

Dissociation Pressure of Oxides and Theory of Oxidizing Refining of Metals. A. N. VOLSKII & YA. YA. SLOBODSKOI. *Tsvetnye Metal.*, No. 1, Jan. 1936, pp. 102-119. Original research. The dissociation pressures of oxides of several metals were determined in relation to their concentration as solvents and solutes in molten alloys using special apparatus in which equilibrium conditions were obtained from both sides, i.e., by oxidizing the pure molten metals with CO-CO_2 mixtures, or by reducing melts containing certain predetermined amounts of oxide with CO. The O concentration in the melts was calculated from changes in the analysis of the gas phase. *1. Determination of dissociation pressure of oxide of solvent metal in relation to its concentration in the melt.* The dissociation pressure of Cu_2O at various concentrations were determined for the reaction (1) $4CU + O_2 \rightleftarrows 2Cu_2O$. The equilibrium constant K'' for the reaction $Cu_2O + CO \rightleftarrows 2Cu + CO_2$ was determined; K''' for the reaction $2CO + O_2 \rightleftarrows 2CO_2$ was taken as $10^{-12.24}$ atm. at 1100° C. The dissociation pressure of Cu_2O increases with its concentration in the melt and becomes constant at concentrations somewhat greater than the accepted value of 4.5% Cu_2O at 1100° (Heyn and Bauer). Formation of a solid solution of Cu_2O in Cu seems possible (not heretofore observed metallographically) because the ratio CO/CO_2 and the dissociation pressure of Cu_2O in solution do not attain the magnitude of free Cu_2O when the concentration of Cu_2O exceeds 4.5% by weight. The average value of the equilibrium constant for reaction (1) was determined at $10^{-6.77}$. 2. *Determination of dissociation pressure of oxide of solute metal in relation to its concentration in the melt.* (a) FeO in Cu-Fe melts: Melts were prepared with Fe content 0.83-12.84 weight %. Pure Fe (99.66% Fe) was prepared by treating pyrophoric Fe in H_2; FeO prepared from Fe oxalate was 98.31% pure. Dissociation pressures at various Fe concentrations were determined at 1150° C. from equations: (2) $2Fe + O_2 \rightleftarrows 2FeO$; (3) $FeO + CO \rightleftarrows Fe + CO_2$, and (4) $2CO + O_2 \rightleftarrows 2CO_2$. The equilibrium constant for (4), acording to Nernst and Wartenberg, is $10^{-11.5}$ The constant for (3) was determined from the analysis of gas mixtures. The dissociation pressure decreased from 6.76×10^{-12} at 0.83% Fe to about 0.40×10^{-12} at 3.15% Fe. The average equilibrium constant for (2) determined from the data is $10^{-15.3}$ Applying the mass action law, the dissociation pressure at 0.10% Fe should be 446.8×10^{-12} atm.; at 0.50% Fe 17.8×10^{-12}, and at 1.0% Fe 4.07×10^{-12} atm. (b). Determination of dissociation pressure of SnO_2 in Pb-Sn melts: The equilibria were studied by oxidizing Pb-Zn melts (1.5 to 72.81% Sn) with CO_2, and by CO-CO_2 reduction of SnO_2 added to the melts. The dissociation pressure of CO_2 was determined for the equation $SnO_2 + 2CO \rightleftarrows 2CO_2 + Sn$, at 900° C., using $10^{-15.18}$ as the equilibrium constant for the reaction $2CO_2 \rightleftarrows 2CO + O_2$. With decreasing Sn content in the melt, the concentration of CO in the gas mixture decreases, and the dissociation pressure of SnO_2 increases as follows: 6.61×10^{-14} atm. at 1.68% Sn by weight, 1.95×10^{-14} atm. at 10% Sn, 1.51×10^{-14} at 25.0% Sn, and 0.76×10^{-14} atm. at 73.0% Sn. BND (2)

2a. Non-Ferrous

Production of Magnesium. *Metal Treatment*, Vol. 3, Spring 1937, pp. 13-15. Translated from *Metallwirtschaft*. Up to date review of history and present methods of reduction of the commercially pure metal. JCC (2a)

Oxidation of Ammonium Sulphite Solution. FRANK S. WARTMAN. *U. S. Bur. Mines, Rept. Investigations*, No. 3339, May 1937, pp. 47-51. Original research. In absorption of SO_2 in $(NH_4)_2SO_3$ solutions, there is always some oxidation to $(NH_4)_2SO_4$. In sulphite solutions, the rate of oxidation is limited by the rate at which the solution will absorb O; in bisulphite solutions, the limiting factor is the rate at which dissolved O reacts with the dissolved salt. Oxidation rate was decreased with increasing bisulphite and with increasing concentration. Gallic acid, tannic acid, catechol, pyragallol, metol and hydrochinon greatly reduce the amount of sulphite oxidized. AHE (2a)

Occurence and Production of Beryllium (Beryllium, Vorkommen und Gewinnung) E. REITLER. *Metallwirschaft*, Apr. 30, 1937, pp. 419-421. Brief comparison of the methods of production of Be in Germany, Great Britain and the U. S. GA (2a)

Distribution of Manganese Between Matte and Slag in the Smelting of Copper. F. S. WARTMAN, G. M. POTTER & M. D. SCHMID. *U. S. Bur. Mines, Rept. Investigations* No. 3340, May 1937, pp. 3-9; **Graphic Representation of the Ratio of Manganese Distribution between Matte and Slag.** M. D. SCHMIDT. *Ibid.*, p. 11. Data are given for distribution of Mn between slag and Cu matte in melts of 1, 6, 10, 20, 30 and 40% Cu in matte and 30% SiO_2 in slag; 25 and 35% SiO_2 in slag and 20 and 30% Cu in matte; and replacement of varying amounts of magnetite by rhodochrosite in the base charge. The ratio of Mn in the slag to Mn in the matte decreases with decrease of Cu in the matte, with a decrease of SiO_2 in the slag, and with an increase of Mn in the matte. MnO (in slog) + FeS $\rightleftarrows$ Mns + FeO (in slag) does not proceed to completion in either direction. The distribution ratio of Mn and Fe sulphides between Cu matte and slag is favorable to the concentration of FeS in the matte and hence to a shift of the equation to the right. Since under the most favorable conditions, the distribution ratio of Mn between slag and matte is not less than 1, and since it is impossible to make a relatively small volume of slag because of impurities in low-grade Mn ore and because of the Fe that must be slagged to form MnS, the use of Cu-bearing matte as a collector of Mn would involve too great a waste of Mn to be a satisfactory method of concentration. AHE (2a)

Recovery of Sulphur in Solid Compounds by the Addition of Ammonia and Water Vapor to Smelter Gas. G. W. MARKS & P. M. AMBROSE. *U. S. Bur. Mines, Rept. Investigations,* No. 3339, May 1937, pp. 31-40. Original research. If a high percentage of the theoretical weight of water vapor required for the formation of $(NH_4)_2SO_3$ or NH_4HSO_3 is present when NH_3, SO_2 and H_2O vapor react, and if an efficient system of baffles is used, practically complete precipitation of reaction products takes place. Air oxidation of the sulphites occurs with varying rapidity, depending upon conditions. Losses of NH_3 sulphites will be fairly large in any process in which NH_3 gas is introduced into smelter smoke when the temperature of the settling chamber is more than 50°. AHE(2a)

Diethylene Triamine and Other Amines as Agents for the Recovery of Sulphur Dioxide. G. W. MARKS & P. M. AMBROSE. *U. S. Bur. Mines, Rept. Investigations,* No. 3339, May 1937, pp. 41-46. Original research. Aqueous solutions of diethylene triamine and triethylene tetramine are excellent absorbers for SO_2 up to 95° provided that the difference in pressure of this gas over the solution and that in the solution are high enough. Losses of amine during runs over several days were small. On boiling aqueous diethylene triamine solutions that have been saturated with SO_2, a large part of the gas is liberated. Analytical procedures for the determination of SO_4^{--} and amine in amine solutions containing SO_2 are given. AHE (2a)

2b. Ferrous

Sintering in Small Pans (Sintring i smaapannor) HJALMAR ERIKSSON. *Tek. Tid.*, Vol. 67, (Section *Bergsvetenskap*) 1937, pp. 9-13. Sintering is carried out in small pans of welded sheet Fe, 5 ft. in diameter, and of about 1 ton capacity. Pans about twice this size have also been used. The pans are arranged in 2 straight rows, 8 pans in each row, or 12 pans on a circular wheel. Total power consumption 13 kwh./ton sinter, and the cost about 60c/ton (with 25c/hr. for labor). The sintering machine is suited for small blast furnaces using about 5000-10,000 tons of sinter annually. Twelve installations are in operation in Swedish plants. BHS (2b)

Mechanism of Reduction of Silicate Inclusions by Aluminum Additions to Steel (Reduktionsmekanismen vid Inverkan av Tillsatt Aluminium på Silikatinneslutningar i Stål) A. PORTEVIN & R. CASTRO. *Jernkontorets Ann.*, Vol. 120, Dec. 1936, pp. 737-740. Polemical, with reply by AMBERG & HULTGREN *(Ibid,* pp. 740-44). HCD (2b)

Determination of Dimensions of Blast Furnaces (Détermination des Dimensions des Hauts-fourneaux). M. A. PAVLOV. *Rev. Mét.*, Vol. 34, Mar. 1937, pp. 215-224; Apr. 1937, pp. 264-275; May 1937, pp. 327-338. Description of gradual development of blast furnace lines all over the world. See also *Metals and Alloys,* Vol. 7, Apr. 1936, p. MA189L/7. JDG (2b)

Regulation of Oxidizing Properties of Slag to Improve the Quality of Steel. G. PISHCHALKO (Kuznetsk Met. Works) *Stal,* Vol. 6, Apr. 1936, pp. 17-24. In Russian. Practical. Steel produced in the 150 ton open-hearths at the Kuznetsk plant had the best mechanical properties when the slag contained 25-28% (FeO + MnO). HWR (2b)

3. MELTING, REFINING AND CASTING

G. L. CRAIG, SECTION EDITOR

Use of a Centrifuge for the Study of Metallic Alloys. G. KOMOVSKI. *Metallurg.*, Vol. 11, Dec. 1936, pp. 120-122. In Russian. The use of a centrifuge device to keep metals in molten state during centrifuging is described. Applied to Cu-Li, Al-Al_3Ti, Pb-AlLi and Pb-ZnLi alloys the method showed a definite orientation of phases produced by centrifugal action. (3)

Fundamental Considerations in Non-ferrous Sand Control. G. K. EGGLESTON (Detroit Lubricator Co.) *Am. Foundrymen's Assoc.*, Preprint 37-17, 1937, 12 pp. Review plus original research. Some fundamental considerations of sand control in non-ferrous foundries are presented. CEJ (3)

The Rotary Melting Furnace. *Indian & Eastern Engr.*, Vol. 79, Oct. 1936, pp. 404-406. Describes a type of carefully designed mechanically rotated melting furnace built by Stein and Atkinson, Ltd., London, which provides rapid melting with low fuel consumption and low melting loss, suitable for production of the complete range of ferrous and non-ferrous materials, giving as good control over the metal as in the crucible furnace or the electric furnace. APS (3)

The Standardization of Foundry Sand Testing Methods (Contribution à la Standardisation des Méthodes d'Essai des Sables) FR. BOUSSARD. *Fonderie Belge*, Vol. 4, July-Aug. 1936, pp. 450-465. Discusses grain size classifications. FR (3)

Designing Sand Castings for Best Foundry Results. *Product Eng.*, Vol. 8, June 1937, pp. 216-219. Special points to be observed in making sand molds for casting metals and alloys, gray irons and bronzes are discussed at length. Ha (3)

Foundry Mechanization. A. S. BEECH. *Foundry Trade J.*, Vol. 56, Mar. 11, 1937, pp. 209-211; Mar. 18, pp. 233-236. Descriptive. Knocking-out molds, facing sand problems, cooling the sand, synthetic sand, pattern plates, runners, gates and molding flasks are discussed. Several mechanized foundry plants are described. Paper is well illustrated with photographs. AIK (3)

Synthetic Moulding Sands. *Engineering,* Vol. 143, Feb. 26, 1937, p. 248. Review of recent material which has appeared in various journals. LFM (3)

Co-operation in Foundry Is Means for Reducing Costs. *Steel,* Vol. 100, Apr. 19, 1937, p. 70. Report of First New England Regional Foundry Conf. held at Mass. Inst. Tech. Contains abstracts of some of the papers presented. MS (3)

3a. Non-Ferrous

Production of Pressure Tight Castings in 30% Cupro-Nickel. T. E. KIHLGREN (Intern. Nickel Co.) *Am. Foundrymen's Assoc.*, Preprint 37-27, 1937, 28 pp. A method of foundry procedure for the production of pressure tight castings in 30% Cu-Ni is described. It involves melting under slightly oxidizing conditions followed by oxidation of the melt, and subsequent deoxidation, (with both Si and Mn in suitable amounts added 3 to 5 minutes before pouring). Sound castings are readily obtained by the simultaneous addition of 1% of Mn and as little as 0.25% of Si. CEJ (3a)

Some Problems in the Non-ferrous Foundry. R. J. KEELEY (Ajax Metal Co.) *Iron Age,* Vol. 139, Apr. 29, 1937, pp. 46-47, 126. Practical discussion of the various difficulties encountered in the production of sound non-ferrous castings and how they may be solved. If close inspection does not disclose the difficulties, standard foundry practices should be established and variables changed in controlled amounts so that difficulties may be remedied. VSP (3a)

Casting Non-ferrous Billets. GILBERT EVANS. *Metallurgia,* Vol. 15, Nov. 1936, pages 7-10. Discusses recently introduced methods for casting Cu and Cu alloys. (3a)

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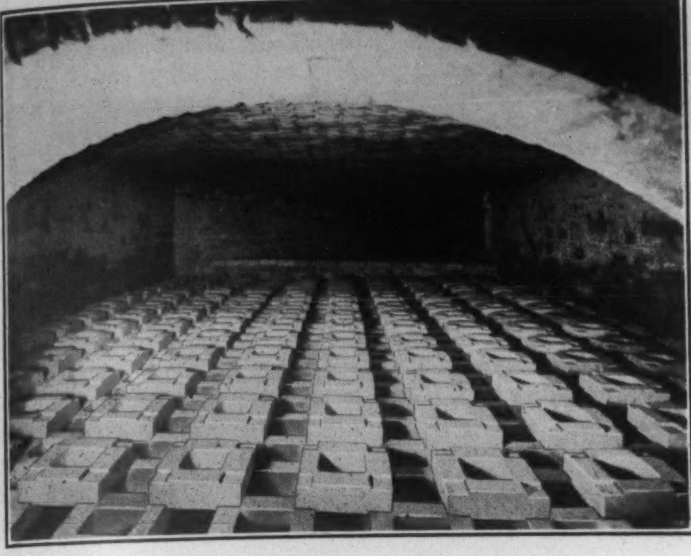

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Metal Production by Modern Methods. *Chem. Trade J.*, Vol. 100, Apr. 2, 1937, pp. 289-291. From a bulletin published by the Mond Nickel Co. Account of the methods used in the Ni industry, from mining of the ore to production of the finished metal, by the carbonyl process. MS (3a)

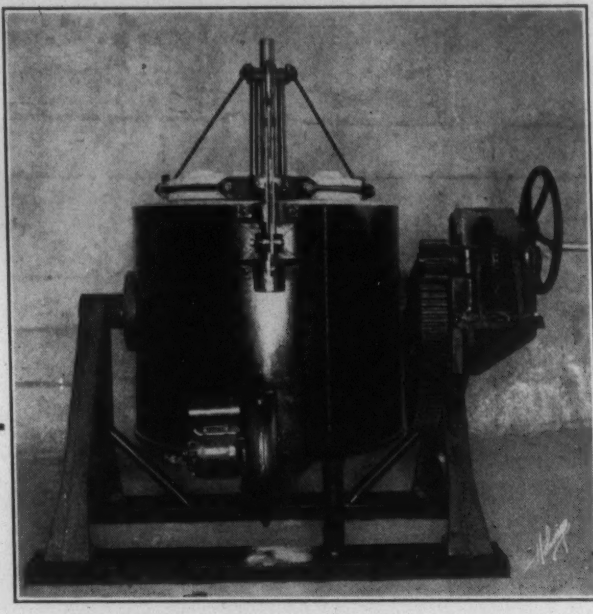
Magnesium and Its Alloys. *Chem. Trade J.*, Vol. 100, Jan. 8, 1937, p. 29. General review. MS (3a)

3b. Ferrous

C. H. HERTY, SECTION EDITOR

Cast Iron as Affected by Coke Size in Cupola Melting. J. A. Bowers & J. T. MacKenzie (Am. Cast Iron Pipe Co.) *Am. Foundrymen's Assoc.*, Preprint 37-11, 1937, 27 pp. To determine the effect that the size of coke might have on the chemical analysis and properties or Fe as melted in the cupola, a series of tests were made in a 21 in. diam. cupola using 4 sizes of coke ranging from 1 to 4 in. Details of the tests and results are reported in 10 tables and 10 curves. Although the authors state that results are considered applicable to 21 in. cupola operation only, the trends are of interest from their possible application to general cupola melting. Some conclusions reached were that S and C increase and Si and Mn losses decrease with each increase in coke size. In longer duration heats, after the first 8 to 10 ladles, the changes in the elements are practically unaffected by changes in coke size. Experiments indicate that there is an optimum size for the coke to be used in a given cupola. CEJ (3b)

Production of Some Iron Castings for Steel Works. J. Roxburgh (Davy Bros.) *Am. Foundrymen's Assoc.*, Preprint 37-10, 1937, 26 pp. Official exchange paper presented on behalf of the Institute of British Foundrymen. Detailed explanations of the problems encountered in the production of some of the larger castings for steel works are given. Types of Fe used are described. The description of the manufacture of a 40-ton ingot mold made by loam molding is presented. Manufacture and composition of representative anvil blocks, cylinders and liners are discussed and illustrated. CMS (3b)



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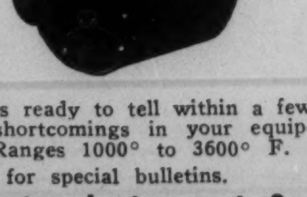

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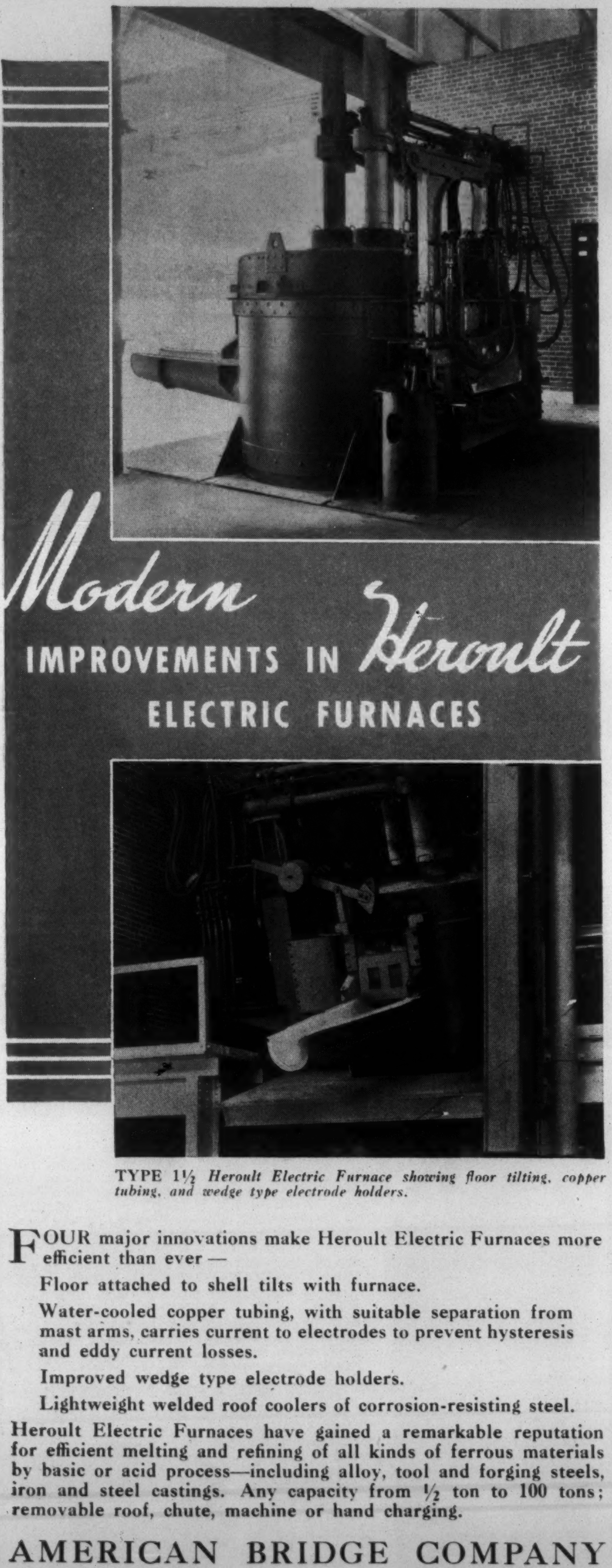

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UNITED STATES STEEL

Studies on the Reactions in the Swedish Acid Bessemer Process (Undersökning Rörande Chargeförloppet vid den Svenska Sur Bessemerprocessen) ISAK FORSLUND & ÅKE WAHLBERG. *Jernkontorets Ann.*, Vol. 120, Nov. 1936, pp. 659-84. Steel was blown from normal Bessemer charges from blast furnaces in a converter producing 24 tons per day with 53 hektoliters charcoal per ton pig Fe. A high Si or Mn content was found to retard the rates as shown by the greater air requirements and the lower temperature increments. The optimum Si content is approximately 1.20% but varies with several factors. As the refining period is increased the oxidation rates of C and Si diminish while that of Mn increases. A certain amount of S removal took place in nearly all charges, the percentage dropping from 0.011 to 0.007. This is assumed to be due to the reaction $2MnS + 3O_2 = 2MnO + 2SO_2$. During the process, spontaneous temperature rises occurred at a temperature of 1,275° C. and ceased a few minutes before "boiling" occurred at 1,300°C. A second type occurred with silicious charges at 1,440°C. and lasted for 2-4 mins. Temperature measurements at the base of the converter gave most consistent indications of the progress of the charge. HCD (3b)

Cast Crank Shafts. *Foundry Trade J.*, Vol. 55, Dec. 17, 1936, pp. 473-475. Description of the methods used in Ford's Canadian Foundry to manufacture cast crank shafts. Forged shafts showed measurable wear up to 10,000 miles of car operation, the cast shaft shows less than 0.0002″. Crank shaft molding, core-oven practice, finishing operations, mold assembly, pouring and stripping, etc., are discussed. The metal is tapped from the furnace into the pouring ladles at a temperature of approximately 1,490° to 1,510° C. the pouring ladles being kept hot by means of a gas jet. The pouring temperature of the Fe at the mold is checked with an optical pyrometer, as temperatures over 1,470° C. will produce a coarse crystalline structure in the metal. In order to reduce shrinkage to a minimum during solidification, mold must be provided with suitable feeders. AIK (3b)

Relation Between Carbon Content and Vapor Pressure in Liquid Steel. (Om sambandet mellan kolhalt och koltryck hos flytande stål.) H. WILLNERS. *Jernkontorets Ann.*, Vol. 120, Nov. 1936, pp. 691-8. Theoretical discussion of some metallurgical data indicates that the vapor pressure of C is not proportional to C content when the latter is greater than 0.5%. HCD (3b)

Very Finely Divided Non-metallic Inclusions, and the Action of Kindred and Foreign Nuclei. R. MITSCHE. Iron & Steel Inst., London, *Carnegie Schol. Mem.*, Vol. 25, 1936, pp. 41-62. Original research. Very finely divided inclusions which are submicroscopic are called "slag clouds," and these are identified by the residue method, by examination under the fluorescence microscope, and by the effects of the clouds on the structure and properties. A general theory relating to nuclei is put forward, and transformation processes such as solidification and changes within the solid state are explained through the combined working of two different kinds of nuclei, described as "kindred" and "foreign" respectively. Kindred nuclei include metal lattice residues from the stable condition before a transformation, and foreign nuclei include non-metallic inclusions. According to the theory kindred nuclei encourage the formation of the particular lattice to which they belong. Foreign nuclei may accelerate or delay transformations. The nuclei, in order to be operative, must be present in sufficient number and in a state of sufficiently fine sub-division, and they must be stable in this condition. The combined effect of Si and Al produces a suitable cloud for melts in which Fe is the main component. The working of deoxidizers should be considered from the standpoint of their ability to form suitable clouds of foreign nuclei. The connection between the question discussed and the problem of flotation of non-metallic inclusions in metallic melts is studied, and it is shown that it may be technically desirable either to remove the inclusions or to control their quantity and distribution depending on circumstances. 9 references. CW (3b)

Production and Properties of Ni-Tensyl. *Foundry Trade J.*, Jan. 28, 1937, pp. 104-106. Extracted from a communication from the research and development department of the Mond Nickel Co. The base Fe contains 2.5 to 3.0% TC., 0.5 to 0.8% Si, 0.7 to 1.0% Mn, 0.12% max. S and 0.2 max. % P. High P content should be avoided. The bath should be inoculated shortly before pouring by adding to the bath sufficient Ni and Si to give effective graphitization. Satisfactory results have been obtained over a wide range of section thicknesses from a standard composition containing 1.5% Si and 1.5% Ni. Risers must be large enough to ensure a self-feeding action. The tensile strength usually reaches 25 tons/in.^{2} Ni-Tensyl combines a high strength matrix with a finely dispersed form of graphite. Hardness values as high as 280 Brinell have been reported and yet the metal is more machinable than ordinary cast Fe. It is suitable for castings to resist wear, heat, corrosion and impact. AIK (3b)

The Graphite Structure of Grey Cast Iron and its Modification. J. G. PEARCE. *Foundry Trade J.*, Vol. 56, Mar. 18, 1937, pp. 229-231; Mar. 25, pp. 250, 251, 256. Review of work done during the past 8 yrs. by the Brit. Cast Iron Research Assoc. It had been demonstrated that the conversion of flake to supercooled graphite could be accomplished by melting a kish-free iron, incorporating 1 to 2% of Fe-C-Ti and then treating the molten metal with CO_2 for 2 min. The experiments suggested that both flake graphite and supercooled graphite structures arise through the generation of inclusions in the melt. In ordinary flake graphite irons the inclusions are solid and crystalline. When the metal solidifies, these inoculate the melt. In cases where supercooled graphite is deposited, it is suggested that the inclusions are still liquid externally when the metal solidifies, so that these do not inoculate the melt which subsequently supercools. Inclusion-free melts also supercool. It is suggested that in the case of Ti treatment, Ti is oxidized and forms a fluid slag of low melting point which coats the existing particles and prevents them from inoculating the melt. A number of experiments were tried on crucible melts, the established procedure being to add 2% Fe-C-Ti and then to bubble CO_2 for 2 minutes, through a ½ in. diam. steel tube, protected by a plumbago sleeve where it entered the metal. The refinement was not complete and varied from one to another. It was observed that the Fe-C-Ti (melting point about 1,400°C.) was difficult to dissolve. Fe-Si-Ti (20% Ti) was therefore obtained, having a melting point of about 1,200°C., which gave much better results. Inasmuch as cupola melting is carried out at comparatively low temperatures, an alloy addition was developed, having a still lower melting point of about 1,000° C. It was obtained by dissolving 35-80% Fe-Mn and 15-20% Fe-P in the above-mentioned Fe-Ti alloy. The best yield of Ti in the molten metal was obtained by wrapping the Ti alloy in a thin steel sheet packet and plunging it below the surface of the metal with a heated plumbago plunger. AIK (3b)

Influence of Melting Conditions in Acid Open Hearth Furnace on Non-metallic Content of Steel. P. N. IVANOV, S. ZAMOTAEV & E. MOROZOVA. *Metallurg.*, Vol. 12, Jan. 1937, pp. 27-34. In Russian. Original research. Investigation covered 45 heats made in a 12-ton acid furnace to contain 0.2-0.5% C. Non-metallic content was determined by dissolving samples in 10% HCl and analyzing the residue for SiO_2. Five samples were taken from each heat and the Si content plotted on a chart. The figures so obtained varied from 0.003 to 0.140% SiO_2, but, for calculations, all samples containing more than 0.050% SiO_2 were disregarded. Many graphs constructed on these data show that for minimum non-metallic content the steel has to melt down with 0.80-0.85% C and 0.35-0.45% Mn, boiling period should be limited to 2-2½ hrs. resulting in C elimination rate of 0.23-0.27% C per hr., ore consumption to be limited to 1.8-2.2% keeping ferromanganese used during the heat within 50-100 kg. (3b)

The Running Quality of Liquid Malleable Iron and Steel. W. RUFF (Iron & Steel Inst., London) *Carn. Schol. Mem.*, Vol. 25, 1936, pp. 1-39. Original research. Results obtained by applying the variable gate technique to a cast spiral created a need for new principles to relate the velocity of flow with the length of run. For the purpose of determining the velocities of flow a special discharge method was developed, and by means of this it was shown that the laws of flow as determined for other liquids were obeyed. In the case of metals that solidify readily, these laws of flow operate jointly with thermal laws and the combined effect is best ascertained by determining the conditions of flow when the length of run is at a maximum. The testing apparatus suggested by these considerations is explained, and recommendations are made for its application, especially for purposes of control over steel melts. 11 references. CW (3b)

A Belgian Steel Foundry Sand for Cast Iron. COLIN D. ABELL. *Foundry Trade J.*, Vol. 55, Dec. 31, 1936, pp. 503, 505. Original investigation. This sand, a single base sand, is so resistant to deterioration when used in cast Fe foundry practice that less than 5% of new sand is ordinarily necessary for purposes of reclamation. Its bond strength (about 18-22 lbs./in.^{2}) and permeability are very good, but its special property is the bonding material, the analysis of which is given below.

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	H_2O (105°C.)	Loss at 450°
Wet:	14.37%	2.95%	15.60%	4.01%	2.90%	52.65%	7.37%
Dry:	30.49	6.38	32.98	8.46	6.16	....	15.58

Another characteristic feature is the remarkable uniformity of the major portion of the sand grains, whose average size is about 0.20 to 0.25 mm. The grains are neither rounded nor are they entirely angular. Generally the sand contains only silica grains and is free from the trouble encountered in sands with higher proportions of easily fusible silicates and alkalis. The author has made tests that show that ordinary milling cannot develop the full strength of these Fe-bonded sands and that they must be subjected to a temperature of about 80 to 100° C. AIK (3b)

4. WORKING

Working of Nickel-base Alloys. F. L. LAQUE. *Mech. Eng.*, Vol. 59, Mar. 1937, pp. 175-177, 181. Heat-treatment, machining, and welding of Monel, nickel, Inconel and Hastelloy are described; the practice for these metals is similar to steel. For hot working operation, the temperature should be: for Inconel 2300°-1600° F., Monel 2150°-1600°, Ni 2250°-1250°; best temperatures for bending are 2250°-1900° F. Speeds and feeds for machining and currents to be applied in electric welding are tabulated. Ha (4)

4a. Rolling

S. EPSTEIN, SECTION EDITOR

The Resistance of Copper to Deformation by Hot Rolling (Der Formänderungswiderstand von Kupfer beim Warmwalzen) O. EMICKE & K-H. LUCAS (Bergakademie, Freiberg) *Z. Metallkunde*, Vol. 29, Jan. 1937, pp. 10-16. Discussion and original research. The effect of the ratio of the thickness of the material to roll diameter on the resistance to deformation is determined for Cu at 650°, 750°, and 850° C., also the effect of rolling speed and pressure. All measurements are made by an oscillograph method previously described. The data are recorded in a three-page table. It is shown that power consumption can be calculated from this by a formula which is based on rolling data and the static resistance of the material to deformation. GD (4a)

The Effect of Cast Structure on the Rolling Properties of Zinc. L. NORTHCOTT (Res. Dept., Woolwich) *J. Inst. Metals*, Vol. 60, 1937, Advance Copy No. 764, 16 pp. *Engineer*, Vol. 163, Mar. 19, 1937, p. 329; *Engineering*, Vol. 143, Mar. 19, 1937, pp. 323-324. Original research. Casting temperature had little effect on structure, density, tensile strength, notched-bar impact, or rolling properties. In columnar crystals the strength measured in the direction of growth is about 4 times that at right angles to it. Selective weakness along one set of planes was also shown by tears on machining. The plane of weakness was found by X-ray examination to be (0001). This plane lies parallel to the line of crystal growth. Specimens could be cold rolled without tearing after a reduction of at least 40% by hot rolling. The importance of equi-axed crystals, such as are formed on hot rolling, was confirmed by tests on specially prepared ingots of equi-axed structure. Columnar crystal aggregates could be completely cold rolled if the direction of rolling between light passes was changed according to a crystallographic plan provided that the plane of growth of crystals is in the rolling plane. No indications were found that any of the peculiarities of Zn in working were due to boundary effects. Failure of Zn at atmospheric or moderately elevated temperatures takes place by characteristic transcrystalline cracking in which the cracks tend to occur along the basal plane in any one crystal. (Addition of 0.75% Cd to Zn produced a small crystal structure but higher recrystallization temperature.) Ingots can be rolled directly on cooling from casting provided initial reduction is in the range 350-100° C. JLG + LFM (4a)

Causes of Cracking During Cold Rolling of 68-32 Brass Ingots. S. A. KUSHAKEVICH. *Metallurg*, Vol. 12, Jan. 1937, pp. 100-106. In Russian. The major reason for cracking lies in the presence of tears, blow holes and β phase in the skin of ingots. (4a)

Roll Problem in Back-up Mills for Cold Reduction. GEO. A. V. RUSSELL & S. S. SMITH. *Engineering*, Vol. 143, Mar. 5, 1937; pp. 271-273; Mar. 26, 1937, pp. 362-363. *Blast Furnace Steel Plant*, Vol. 25, Mar. 1937, pp. 315-316. See *Metals and Alloys*, Vol. 8, Mar. 1937, p. MA140R/6. LEM+MS (4a)

High-yield Resilient Tin Plate. *Iron Age*, Vol. 139, June 10, 1937, pp. 51-52. Briefly considers the advantages and disadvantages of cold and hot pack rolling of Sn plate and describes high-yield resilient Sn plate developed by Norman Goss of the Cold Metal Process Co., Youngstown. By this method cold rolled plate is available without excessive loss of ductility. It consists of a heat treating cycle which is coordinated with final cold rolling pass of 12% or more; the result being a Sn plate suitable for cans. It may be made from Bessemer, open-hearth or Cu bearing steel. Characteristic property is its uniformity of physical properties from sheet to sheet. VSP (4a)

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Steelworks Finishing Plant. *Mech. World Eng. Record,* Vol. 101, Mar. 12, 1937, pp. 266-268. Illustrated description of new equipment installed at the works of the Appleby-Frodingham Steel Co., Ltd., for bars and sections as they come from the rolling mill. They are cut to ordered lengths, gradually cooled, straightened, checked and despatched in short space of time. EF (4a)

4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

Factors Relating to the Production of Drop and Hammer Forgings. A. M. STEEVER (Columbia Tool Steel Co.). *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 1-22; *Heat Treating Forging,* Vol. 23, Jan. 1937, pp. 20-24; Feb. 1937, pp. 71-74. With discussion. Review of drop hammer practice and its development. The manufacture of dies, forging temperatures and grain flow are discussed, and the steam consumption is given for steam hammers under varying conditions. GEG + MS (4b)

Cold Heading—Bolts, Rivets and Nails. R. H. SMITH (Lamson & Sessions Co.). *Trans. Am. Soc. Metals,* Vol. 25, Mar. 1937, pp. 84-96. With discussion. Description of modern cold heading practice. Single and multiple-blow heading methods are discussed and recent developments in multiple-die single stroke machines are described. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 349R/4. GEG (4b)

Extruded Zinc Parts. H. CHASE. *Product. Eng.,* Vol. 8, June 1937, pp. 214-215. A recently developed process for mass production of complex shapes of Zn die castings by single impact extrusion is described, and examples given Ha (4b)

Three Decades of Development in Drop Forging Hammers. MACDONALD S. REED (Erie Foundry Co.) *Steel,* Vol. 100, June 7, 1937, p. 46-49. Traces changes in design and construction of hammers from 1907 to date. MS (4b)

High Quality Wire from New Joliet Mill. *Blast Furnace Steel Plant,* Vol. 25, July 1937, pp. 719-722. Describes continuous rod-mills recently placed in operation by Am. Steel & Wire Co., Joliet, Ill. MS (4b)

4c. Cold Working — Shearing, Punching, Drawing & Stamping

Some Practical Notes on "Casting" Wire. WM. GOULD. *Wire & Wire Prod.,* Vol. 12, Apr. 1937, pp. 177-181. A "dead cast" wire is defined as a wire which will have zero vertical pitch and proper coil diameter when permitted to lie unrestrained by any external forces. Internal forces are assumed to be balanced; if they are not the wire is "cast off" or "wild." A study of drawing is made to find the conditions which have to exist in order to produce perfectly cast wire. Although no definite conclusions can yet be drawn it was found that tilting the die slightly (at the most 5°) in two planes at right angles by means of small pieces of metal packed in behind the die and its holder, eliminated entirely "wild" wire. The various practical points to be observed are discussed in detail. Ha (4c)

Studies of the Wire-drawing Process. VIII.—A Note on the Effect of the Speed of Drawing on the Influence of Aging on the Tensile Properties of Certain Steel Wires. E. L. FRANCIS (Univ. Manchester) *Iron Steel Inst., London,* Carnegie Schol. Mem., Vol. 25, 1936, pp. 63-67. Original research. Over the range 10 to 600 ft./min. the speed of drawing appears to have no influence on aging. The influence of the reduction of area appears to be slight. There is some evidence that aging occurs in a periodic manner. 2 references. **IX.—Does the Phenomenon Known as the "Alkins Effect" Occur in Certain Ferrous Alloys?** *Ibid.,* pp. 69-79. Original research. The mechanical properties of a number of cold-drawn steels have been investigated. The materials investigated contained 0.065, 0.2, 0.3, and 0.5% C respectively. No evidence was found that these steels show the phenomenon of the "Alkins effect," which occurs fairly generally among metals and alloys of the face-centered system. 15 references. See *Metals and Alloys,* Vol. 6, Sept. 1935, p. MA 354R/4. CW (4c)

New Experimental Results on Deep Drawing of Cylindrical Vessels (Nyare forskningsresultat beträffande djupdragning av cylindriska kärl) GEORGE SACHS. *Tek. Tid.,* Vol. 67, Apr. 17, 1937 (Section *Mekanik*), pp. 33-38. Comprehensive review. See *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 578R/9. BHS (4c)

Cold Processing Alloy Steels. R. SAXTON. *Wire & Wire Prod.,* Vol. 12, Apr. 1937, pp. 195-200. British practice of cold-drawing, the alloys amenable to cold work, detection of flaws and defects, grain structure and preparation of work are discussed. Ha (4c)

4d. Machining

H. W. GRAHAM, SECTION EDITOR

Cold Working of the Surface of a Material by Different Machining Methods (Die Kaltverformung der Werkstoffoberfläche bei verschiedenem Bearbeitungszustand) H. MÖLLER & A. ROTH. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch. Düsseldorf.,* Vol. 19, No. 4, 1937, pp. 61-63. Original research. The depth to which cold working penetrates below the surface was determined for 2 types of steel. Grinding, polishing, etc., penetrates about 0.2-0.3 mm., while roughing, drilling, etc., penetrate 0.5-0.6 mm., and sometimes more. The depth was determined by the X-ray reflection method. 6 references. Ha (4d)

Drilling of Aluminum Sheet (Bohren von Aluminiumblech) W. WALBERSDORF. *Z. Ver. deut. Ing.,* Vol. 81, Feb. 27, 1937, p. 280. Practical. To obtain a hole in Al sheet which is as circular as possible (a triangular shape, for instance, results from high cutting velocity and light feed) and free of burr at the end the drill should approach the end with high cutting velocity and correspondingly high feed; the latter should then be reduced to about 1/5 at about 0.3-0.4 mm. before the drill gets through the opening. Effect of size and shape of drill are discussed. Ha (4d)

Machinability. G. SCHLESINGER. *Automobile Engr.,* Vol. 26, Dec. 1936, pp. 501-503. General discussion. Relations between hardness, machinability and resistance to wear are discussed from the physicist's, the production engineer's and the user's standpoints, of which the last is usually decisive in the choice of a material. Methods of testing machinability, and influence of machining methods on the results are described. Ha (4d)

Machining of the Ford 60-Hp. V-8 Engine. FRANK J. OLIVER (Staff) *Iron Age,* Vol. 139, May 13, 1937, pp. 42-47. A well illustrated description of the procedure. VSP (4d)

5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

New Heat Treating Method Improves Rails. *Transit J.*, Vol. 81, June 1937, p. 205. Descriptive. "Brunorizing" brings about a refinement of grain structure which results in greater toughness, ductility and resistance to breakage. The rails are re-heated after being cooled to a temperature of 900° F. to 1100° F., are transferred from the cooling bed to a roller table, spaced evenly and delivered to the re-heating or Brunorizing furnace. Possible slightly lower hardness and tensile strength are claimed to be more than offset by improved ductility and toughness. WHB (5)

Defects in Heat-Treatment. A. A. ROBERTSON (Melbourne Tech. College) *Wild-Barfield Heat-Treatment J.*, Vol. 2, June 1937, pp. 64-66. Practical. See *Metals and Alloys,* Vol. 8, May 1937, p. MA 274L/1. FPP (5)

Heat Treatment of Small Steel Parts. A. A. ROBERTSON (Melbourne Tech. College) *Commonwealth Engr.*, Vol. 24, Oct. 1, 1936, pp. 107-109. Superficial discussion. EF (5)

New Heat Treating Method Improves Rails. *Transit J.*, Vol. 81, June 1937, p. 205. Describes "Brunorizing" process. See *Metals and Alloys,* Vol. 8, June 1937, p. MA358L/3. WHB (5)

5a. Annealing

Molten Salt Baths Internally Heated. A. E. BELLIS (Springfield Armory). *Metal Progress,* Vol. 30, Dec. 1936, pp. 68-72. Descriptive discussion. Molten salt is heated in cast metal pots of great wall thickness by electric current passing either between multiple electrodes or the electrodes and pot wall. Stored heat may be utilized successively annealing material which requires lower and lower annealing temperatures. GEG (5a)

5b. Hardening, Quenching & Drawing

Heat Treatment of Chromium-molybdenum Steels in the Salt Bath (Ueber die Behandlung von Cr-Mo Vergütungsstählen im Salzbad) W. HENNINGER. *Durferrit Hausmitt.*, Vol. 6, Feb. 1937, pp. 131-136. Practical. In order to improve the wear resistance gears of Cr.Mo steels, they are best heat treated to a cyaniding bath subsequent to the regular heat treating process. The heat treatment consists in quenching in oil from 850° C. followed by drawing at 200° C. After this heat treatment, however, the steel possesses rather unsatisfactory wear resistance and a tendency to high notch sensitivity. By a subsequent treatment in a cyaniding bath at 830°-850° C. and air cooling the wear resistance is increased and notch sensitivity decreased. Automotive gears of Cr-Mo steels thus treated are hardly inferior to ordinary case-hardened gears. They possess sufficient toughness and strength, little distortion and quiet running qualities. GN (5b)

Beam Flanges Are Flame Hardened. H. O. JONES (Air Reduction Sales Co.) *Steel*, Vol. 100, May 24, 1937, p. 41. Flanges of 16-in. Man-Ten steel H-beams were flame hardened to 450-500 Brinell hardness for a depth of at least 3/32 in. Width of track hardened was 4 in. Torch tip, 2 in. wide, made 3 overlapping passes. MS (5b)

Phototube Temperature Control. R. A. POWERS (Electronic Control Corp.) *Electronics*, Apr. 1937, pp. 12-15. Description of new apparatus. Lists successful adaptation to heat treating, forging and rolling, and Fe cupola temperature control units. Describes unit for automatic heat treatment of valve stem tips, with wiring diagram, photographs of units, and photomicrograph of heat treated valve tip. DJM (5b)

Surface Hardening by Local Heat Treatment. *Metal Treatment,* Vol. 3, Spring 1937, pp. 43-45, 47. Descriptive. In the shorter process, plain steels with more than 0.4% C and alloy steels are surface hardened by automatically traversing the parts with a neutral oxy-acetylene flame, which is closely followed by a jet of water. Gears, shafts, punches and dies are among the parts successfully treated. JCC (5b)

Hardening Steel by Superficial Quenching Using Oxy-acetylene (Le Durcissement de l'Acier par Trempe Superficielle Oxy-acetylenique). CH. DEHASSE. *Rev. Universelle Mines,* Vol. 13, June 1937, pp. 237-248. After commenting on the other hardening methods, hardening with an oxy-acetylene torch is described. JDG (5b)

5c. Aging

Metallurgical Research in the U.S.S.R. NICHOLAS W. AGEEW. *Metal Ind., London,* Vol. 50, Jan. 1, 1937, pp. 3-8. A review of recent Russian research in the field of systems in equilibrium. Gives diagrams of Pd-Fe, Pb-Bi, Pd-Sb, Mg-Cd, Al-Mg-Zn, Pb-Na-Ca, Al-Cu-Si. Discusses the phase transformation in aging duralumin and eutectoid transformations, in Fe-C, Al-Zn, Sn-Cu, and Mg-Cd. 35 references. RWB (5c)

5f. Nitriding

Surface Hardening of Steels by Nitriding. *Chem. Eng. Mining Rev.*, Vol. 29, Mar. 8, 1937, pp. 245-246. Remarkable properties are conferred on thin surface layers by reaction with ammonia. Nitrided case remains hard right up to the temperature to which it is heated. Nitralloy steels and a special cast Fe known as Nitricastiron are subjected to the action of ammonia gas at a temp. of 500° C. for the period required to produce the necessary depth of case. WHB (5f)

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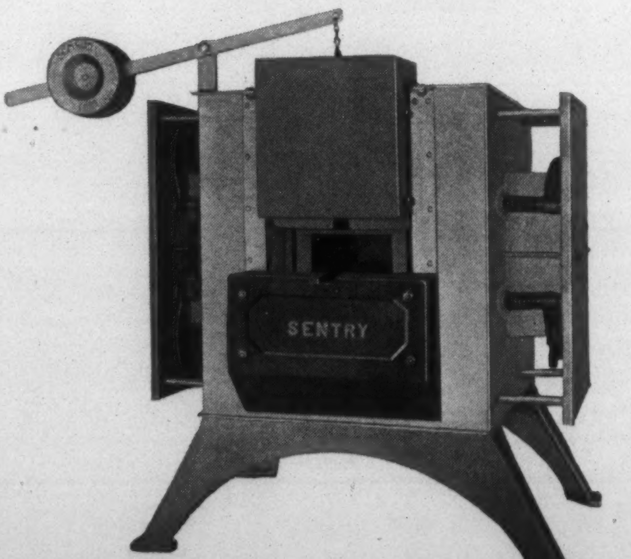

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6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

Refractories, Report of A.S.T.M. Committee C-8. J. D. SULLIVAN, Chairman. *Am. Soc. Testing Materials*, preprint for June 1937 meeting, 27 pp. Progress report. Includes Proposed Tentative Methods of Test for Cold Crushing Strength and Modulus of Rupture of Refractory Brick and Shapes (issued 1937). Proposed Tentative Definitions of Terms Relating to Alumina-Diaspore Refractories (C 71-T, issued 1937) and Proposed Tentative Methods of Chemical Analysis of Refractory Materials (C 18-T, revised and reissued 1937). VVK (6)

Setting New Standards for Blast Furnace Runs. G. G. COOLIDGE (Harbison-Walker Refractories Co.) *Blast Furnace Steel Plant*, Vol. 25, May 1937, pp. 493-495. Survey. Deals with record runs on a single lining, from 1875 to the present. In 1908, 1,000,000-ton mark was reached. Production of 1,500,000 tons was achieved by 1922, and it was not until 1936 that total production of 2,000,000 was reached. Several furnaces seem likely to surpass this mark. Application of power-pressed brick has helped to increase lining life. MS (6)

Gas Fired Furnace for Normalizing Steel Castings Has Cooling Door. RALPH M. FISHER (Reed Foundry & Machine Co.) *Steel*, Vol. 100, June 7, 1937, p. 86. Descriptive. Insulated, car-type furnace normalizes 7 tons of average-sized castings in 1 load. There are 12 staggered low-pressure, McKee-type burners, 6 firing below and 6 above the castings. Low-pressure blowers and other equipment are located at top of furnace. Cooling door of steel, chamfered and perforated and packed with glass wool, opens and closes independently of insulated door.. MS (6)

Ceramics as Insulators. *Electronics*, Feb. 1937, pp. 7-10. Review of the available ceramic insulation materials and their properties [written for radio and allied fields but of metallurgical interest. D.J.M.] DJM (6)

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The Manufacture of Dolomitic Bottoms of Thomas Converters (Contribution à la Fabrication des Fonds dolomitiques pour Convertisseurs Thomas) J. WELTER. *Rev. Tech. Luxembourg*, Vol. 29, Jan./Feb. 1937, pp. 1-7. Efforts to improve the life of converter bottoms and at the same time to supply the blast under the best possible conditions are reviewed and several methods described; an entirely satisfactory solution has not yet been found. One of the latest developments is a bottom built up of short pipes of dolomitic material (DRP 524195, French Pat. No. 679719) which has given 8 mos. unbroken service. The pipes or tubes are slightly conical, diam. 185/180 mm. and are made under hydraulic pressure of 1,420,000 lbs./in.^{2}. The machine is described. 9 references. Ha (6)

Bright Anneals Copper Wire. *Steel*, Vol. 100, Mar. 22, 1937, p. 62. Describes briefly new continuous, special atmosphere, electric furnace. It is of the straight through, pusher type, 85 ft. long. Heating elements are heavy cast Ni-Cr alloy grids located in roof and bottom. Operates at 700°-1000° F. Daily capacity is 36,000 lbs. of Cu wire. MS (6)

Suspended Arches for Combustion Chambers. *Indian & Eastern Eng.*, Vol. 79, Aug. 1936, pp. 166-167. Descriptive. For a number of yrs. standard practice for the combustion chambers of water tube boilers has included the use of the suspended arch, that is, independent refractory blocks hung from overhead steel girders, and the same principle is now in extensive use for other furnace settings especially in the Fe and steel and ceramic industries. Advances in this field are along the same lines as the pioneer standard suspended arches and walls, except that the refractory blocks are half the width and, instead of being plain, all four sides are now made with horizontal corrugations or treads. APS (6)

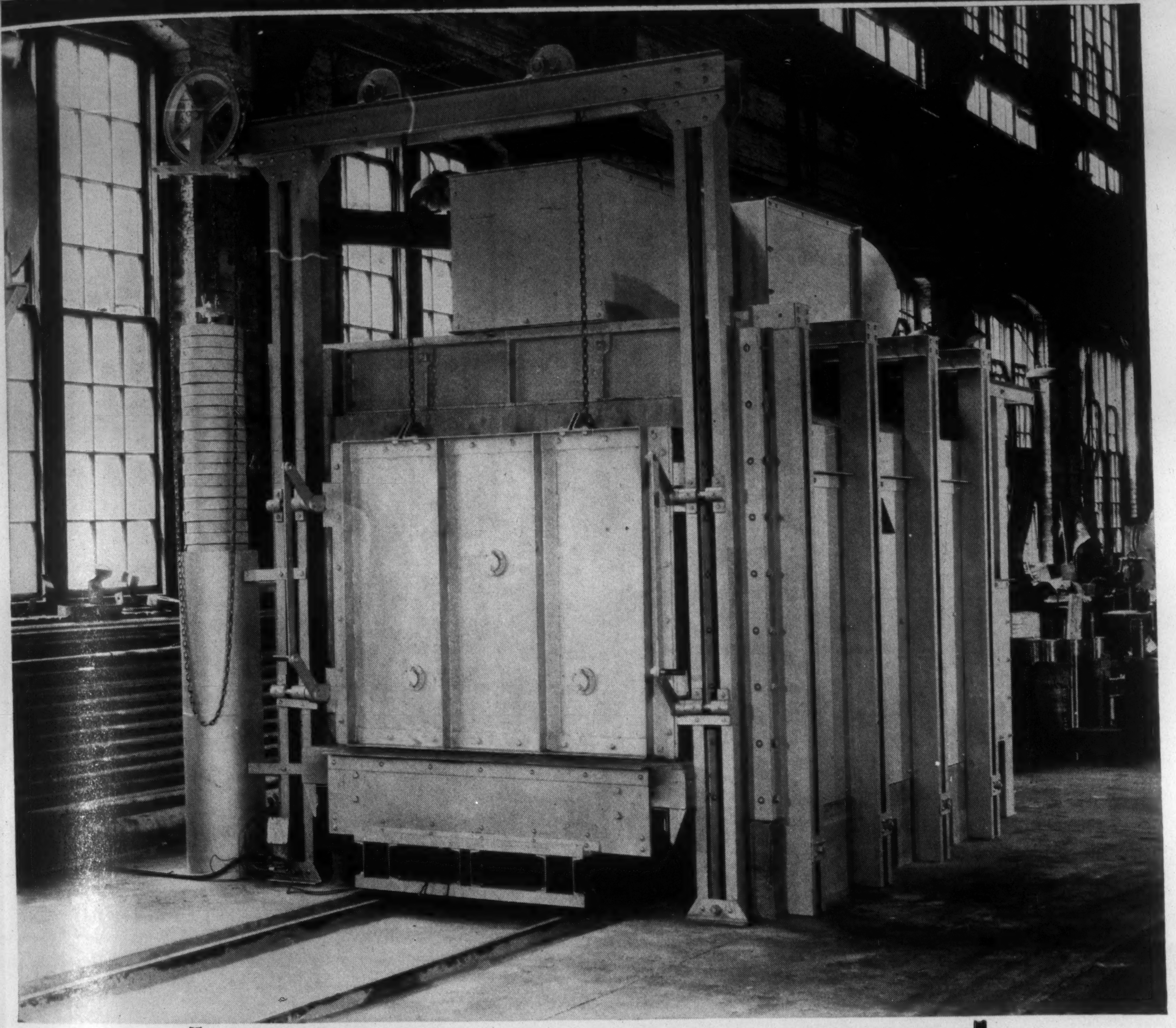
The Tension Electric Heat Treatment Process for Long Steel Members. H. N. WYLIE. *Wild-Barfield Heat-Treatment J.*, Vol. 2, Mar. 1937, pp. 46-50. Practical. A method of heating long steel tubes, strip and bars by passing electric current directly through the piece to be treated, is described. Complete details of procedure in treating air-hardening Ni-Cr-V steel aircraft members are given; tension is applied to the material during heating, to prevent sagging, as the stock is supported only by the terminal clamps through which is passed the electric current. Time required for heat treating each member is from 5 to 30 minutes, depending on the size of the piece. Advantages claimed are economy, uniformity of heating, avoidance of stress damage during treatment, convenient handling and thinness of scale formed. FPP (6)

Determination of Forging Furnace Efficiency. JOHN A. WEBBER (Interstate Drop Forge Co.) *Heat Treating Forging* Vol. 23, May 1937, pp. 245-248. From tests made on 3 furnaces in commercial production, it is concluded that lbs. of steel heated per gal. of oil used is directly proportional to lbs. of steel heated; automatic temperature control increased efficiency of 1 furnace, but cut down capacity considerably; pre-heating air will not always result in fuel savings; and any means of increasing heat transfer by radiation will effect definite fuel economies and less scaling. MS (6)

Improvement in Open Hearth Furnace Design. I. D. SEMIKIN. *Teoria i Pract. Met.*, No. 1, 1937, pp. 12-24. In Russian. All elements of open hearth furnace and checker design are critically examined in the light of modern conceptions. Best results of both practical and theoretical considerations are incorporated in a design of a furnace having 55 square meters bath surface and 190 ton charge. (6)

Important Factors in the Construction of Electric Furnaces (Die Wichtigsten Begriffe im Elektroofenbau). W. FISCHER. *Elektrowärme*, Vol. 7, June 1937, pp. 123-124. Design and operating factors are compiled and defined. Ha (6)

High Frequency Induction Furnaces for the Production of Alloy Steels. *Elec. Times*, Vol. 91, June 3, 1937, pp. 783-784. Descriptive. At David Brown & Sons Ltd., Penstone, 3 high frequency furnaces are used for alloy steel castings. JCC (6)



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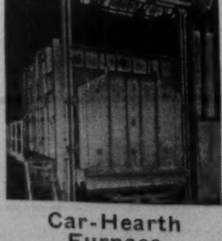
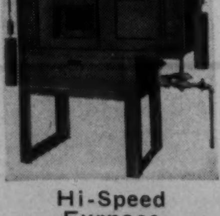
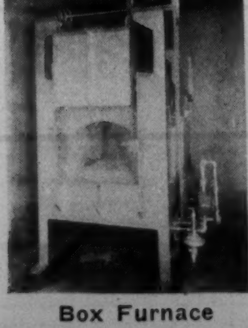


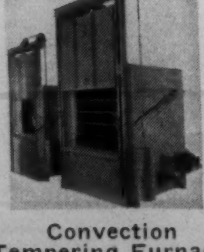
Car-Hearth Furnace



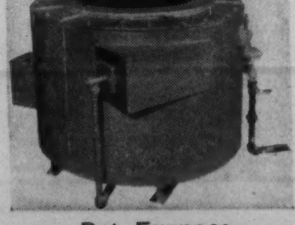
Hi-Speed Furnace



Box Furnace



Convection Tempering Furnace



Pot Furnace

7. JOINING

7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

High-power Welding with Covered Electrodes. Review of Welding Tests. R. Anderson & M. Akeson. *Welding J., London,* Vol. 33, Sept.-Oct. 1936, pp. 262-264. Practical. Test procedure and results are reviewed for .20% C steel plates welded with high power method using "type 2 D" rods up to 12 mm. the plate need not be chamfered for welding. For 20 mm. plate 2 runs one on each side were made with 6 mm. diam. electrode, the plates having slight chamfer. Welding speeds of 14-22 meters/hr. for square butt welding of 12 mm. plate using 6 mm. 2 D electrodes, speeds for other plate sizes and electrode diam, are cited to show high speed of new method. The method is at present limited to max. thickness of 20 mm. plate. Shrinkage stresses are lower, electrode consumption less, power consumption is less for plates above 5 mm. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 364L/1. WB (7b)

Investigation of Welded Aluminum Sheets of Great Thickness (Untersuchung geschweisster Aluminiumbleche grösserer Dicke) H. Buchholz. *Z. Ver. deut. Ing.,* Vol. 81, Apr. 10, 1937, pp. 433-437. Original research. The effect of welding procedure and treatment on the strength of Al sheets was investigated. The structure of X-gas welds of thick Al sheets was found to be much finer than that for V-welds; the former is therefore preferable. V-seams made with the electric arc have a coarser structure than X-welds. The static strength of the weld is, in all welding methods, practically the same as that of the annealed parent material, while at elevated temperatures, the elongation at the high-temperature zone and the elastic limit are reduced considerably. Gas-welded joints seem to contain less slag than electric welds; the skill of the welder is, however, an important factor. Electric and gas-welds with pure Al wire have approximately the same corrosion resistance as the parent material; Si-containing welding rod produces lower mechanical properties than pure Al welds. Ti-alloyed rod gives good strength but less corrosion-resisting welds. Ha (7b)

Welding Cast Iron. A Review of the Literature to Nov. 1, 1936. W. Spraragen & G. E. Claussen. *Welding J., N. Y.,* Vol. 16, Mar. 1937, Supplement pp. 2-32. Complete, thorough review of methods, materials, metallurgical factors and microstructures, physical and mechanical properties, flame cutting and other cutting methods. A number of research problems are suggested. The data from the literature are assembled in numerous tables and curves and appendices give average properties of unalloyed cast Fe and cast steel, Monel and 60-40 brazing rod. 340 references. **Welding Cast Steel. A Review of the Literature to Nov. 1, 1936.** *Idem.,* Apr. 1937, Supplement pp. 2-11. Digest of the literature summarizing results, with discussion. Tables include results of physical and mechanical properties tests from various sources. The results are excellently indexed and information as to properties to be expected are made easily available. Good grades of C cast steel below .30% C are as easily welded as rolled steels of similar composition, higher C and alloy contents require special methods of welding. 85 references. WB (7b)

Study of Spot Welding of Unlike Pairs of Light Metal Sheets (Versuche zur Punktschweissung ungleichpaariger Leichtmetallbleche) H. Röhrig & E. Käpernick (Verein. Aluminium Werke, A.-G.) *Z. Metallkunde,* Vol. 28, Dec. 1936, pp. 385-387. Original research. 6 different pairs of pure Al and its common alloys were spot welded. The lense of welded material extended farthest into the sheet with the lowest melting point. The tensile strength was inversely proportional to the difference in melting point between the two components of the weld. Within the lense the structure and composition is nearly uniform. GD (7b)

Cutting Steel Underwater. Charles Kandel (Craftoweld Equipment Corp.) *Welding J., N. Y.,* Vol. 16, Apr. 1937, p. 31. Cutting speed in 1936 developed to 60 ft. of $\frac{3}{8}''$ steel piling/hr. at depth of 30 ft. Working conditions are variable and sometimes difficult to overcome unless survey of underwater bottom is made. Study is being made of underwater cutting of alloy steels (to prevent carbide zone). WB (7b)

Welded Structures for Hydraulic Turbines. George A. Jessop (S. Morgan Smith Co.) *Welding J., N. Y.,* Vol. 16, Apr. 1937, pp. 2-6. Descriptive. Discussion of actual background affecting choice of composite design of welded plate-steel castings assembly over former all cast structure and production problems involved in various parts, of high strength, where distortionless welding was requisite. Use of composite welding of plate and castings considered important for setting and following exact production schedule with weights figured on exact basis. Cost estimates are more accurate and machining time reduced to minimum with certainty that machining would not uncover defects and lead to rejection. In one case where cost of welded structure is greater than former cast-steel production the former has superior properties which more than compensate. Numerous photos illustrate the fabrication of various units and compare former cast steel production with welded structure. WB (7b)

Modern Autogenous Welding Adapted to the Production of Cylindrical Pressure Vessels (Modern gassvetsning tillämpad vid framställning av cylindriska tryckkärl) H. Spiegelberg. *Tek. Tid.,* Vol. 67, May 1, 1937, pp. 189-93. Practical. Only the best equipment should be used in this work, the burners must be of the correct type and size, the gases should feed by their own pressure and without interruption, and should be carefully cleaned and dried. After drying the gases should not be allowed to pass through any water seal. Tack welding is not recommended, but special designed tools should be used to hold the pieces in position so that the width of the seam remains constant as the welding proceeds. Great care must be used in the selection of a welding rod that will give a weld with fine structure and physical properties equal to those of the piece welded. If possible no welder should be used who has not been given special training for this work, and the welding should be done according to a carefully prepared lay-out. If properly executed no annealing will be required after the welding. BHS (7b)

Tensile Endurance Studies of Specimens with Welded-on Beads and of Lap Welded Joints (Zugschwellfestigkeits-Untersuchungen an Proben mit aufgelegten schweissraupen und angeschweissten Laschenverbindungen) A. Thum, F. Kaufmann & K. Schönrock. *Arch. Eisenhüttenw.,* Vol. 10, Apr. 1937, pp. 469-476. Doctor's thesis. Welded-on beads lowered the endurance limit in tension as much as 40 to 50% whether the beads were longitudinal or transverse to the direction of the test piece. Transverse beads on one side of the specimen showed a smaller lowering. SE (7b)

Portable Tools for Resistance Welding (Elektrische Punktschweisszeuge) Friedrich Hoch. *Electroschweissung,* Vol. 8, Feb. 1937, pp. 21-27. Modern design of hand and compressed air driven pinching and pushing electrodes especially for the welding of less accessible parts, and cooling devices of the flexible cables are described. HR (7b)

Rail Welding. J. G. Hartley (Penn. R. R.) *Welding J., N. Y.,* Vol. 16, Apr. 1937, pp. 7-10. Review of early attempts at rail maintenance by building up, and of present successful torch procedure. Details are given of technique and equipment. Discussion shows defects, laminations under rail head may be cut out with torch but the application of too much heat is stressed as injurious due to penetration below rail head, contraction of unequal mass sections on casting puts high stresses into rail therefore heat must be just sufficient to do the welding. WB (7b)

Factors Affecting the Properties of Welds and the Base Metal Adjacent to the Weld. R. E. Long (Halleys Corp.) *Welding J., N. Y.,* Vol. 16, Apr. 1937, pp. 19-20. Steels for welding are classified as to properties after welding: (1) Sorbitic or pearlitic having strength, ductility, toughness, (2) austenitic having ductility and toughness, (3) martensitic or troostitic, which are hard and brittle. Preheat and after-treatment required for class (3). Plain C steel above .35% C should be preheated. WB (7b)

Physical Properties of Welds. G. E. Claussen (Eng. Foundation) *Welding J., N. Y.,* Vol. 16, Mar. 1937, pp. 16-19. Brief review of tests on all weld and weld assembly specimens for tensile, bend, hardness, impact, fatigue. The properties of base and coated steel electrode weld metal and welds are summarized as obtained from the literature. Some values are included for non-ferrous and cast Fe welds. WB (7b)

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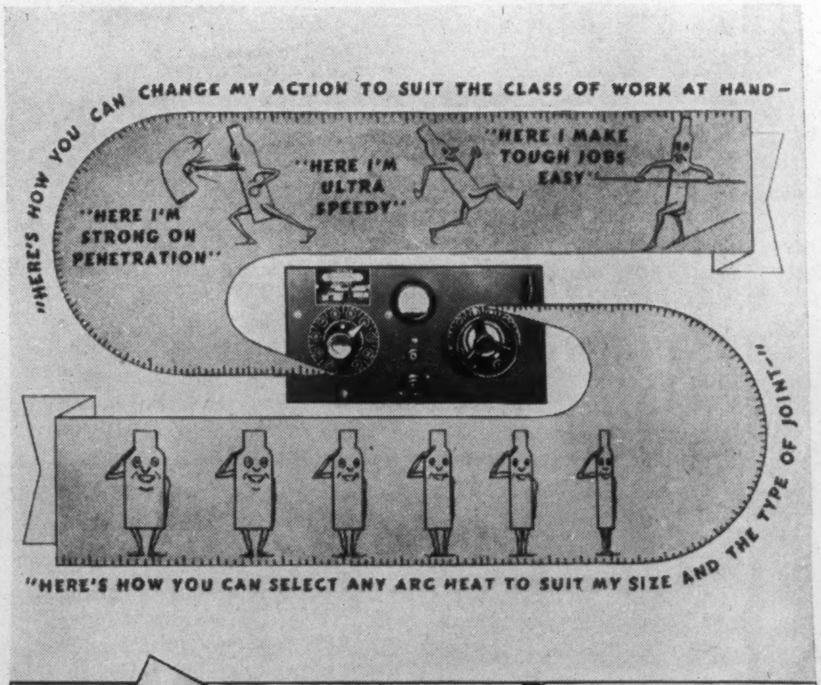
"HERE'S HOW YOU CAN CHANGE MY ACTION TO SUIT THE CLASS OF WORK AT HAND—
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"HERE I'M ULTRA SPEEDY"
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★ **"DUAL *CONTINUOUS* CONTROL** gives you a wider selection of both voltage and current values and 'top' performances at every setting.

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Oxy-acetylene Cutting of Cast Iron. *Mech. World Eng. Record*, Vol. 101, Jan. 29, 1937, pp. 101-103. Descriptive. Although the equipment is essentially the same, cast Fe cutting requires a technique somewhat different from that used in cutting ordinary steel. Dwells upon these differences which lie mainly in the manipulation of the blow pipe, the flame adjustment and the handling of the work in general. EF (7b)

Rebuilding and Facing Manganese Steel Shovel Teeth. DON LLEWELLYN (Air Reduction Sales Co.) *Welding J., N. Y.*, Vol. 16, Mar. 1937, p. 15. Descriptive. WB (7b)

Aluminum Chairs. OWEN C. JONES (Linde Air Products Co.) *Welding J., N. Y.*, Vol. 16, June 1937, pp. 32-33. Description of torch welding of Al chairs assembled by welding 16 joints. WB (7b)

Stainless Steel Scrap Flame-cut Rapidly to Remelting Size. FRED JUDELSOHN (Air Reduction Sales Co.) *Iron Age*, Vol. 139, May 20, 1937, pp. 43-44. VSP (7b)

Structural Welding Mistakes. MARTIN P. KARN. *Welding J., N. Y.*, Vol. 16, May 1937, pp. 15-16. The mistakes in welding are sketched and discussed. Insufficient weld metal or wrong placement introduces stress concentration with consequent fracture at such points. WB (7b)

Proceedings of the XII International Acetylene Congress (Comptes rendus du XII Congrès Intérnational de l'acétylene, de la soudure autogène et des industries qui s'y rattachent). D. SÉFÉRIAN. *Rev. Mét.*, Vol. 34, Apr. 1937, pp. 276-293. Gives abstracts of the papers presented at the Congress. JDG (7b)

Arc Welding in Building Construction. CHARLES H. JENNINGS (Westinghouse Electric & Mfg. Co.) *Welding Eng.*, Vol. 22, Apr. 1937, pp. 19-21. Descriptive. Company erected first all welded building in 1926 and has since constructed 30 all welded structures totalling 12,000 tons of arc welded steel. Two types of connections for beam to column are used: fixed and flexible; first has maximum welding minimum weight of steel, while for the flexible connection the reverse obtains. Description of the welding, (using coated rods) is given; major portion of all welds were 5/16 in. fillets. WB (7b)

Weldability of the Ductile Light Metal Alloys (Ein Beitrag zur Frage der Schweissbarkeit von Leichtmetallknetlegierungen) C. AUCHTER. *Doctor's Thesis of the Technische Hochschule Aachen, 1936*. Original research. Acetylene and arc welds of 4 mm. sheets of silumin (Al + 12.5% Si) and K. S. S. (Al + 2.2% Mn + 2.5% Mg) and gas welds of elektron (98.5% Mg) were examined chemically, mechanically and for corrosion resistance. In comparison with the parent metal, the welds showed increased amounts of Al_2O_3 and also a Cl_2 pick up from the flux. the tensile strength of the silumin and K. S. S. welded sheets was about 65-70% of the original sheet; the gas welded sheets had an elongation double that of the arc welded. The welded elektron sheets had very low physical properties with only 1% elongation in the weld material. The corrosion experiments showed that the corrosion resistance of the welded silumin and elektron had decreased whereas that of the K. S. S. increased. JZB (7b)

Arc Welding Electrodes. A. F. DAVIS. *Transit J.*, Vol. 81, Apr. 1937, p. 130. Welding electrodes for various purposes are listed. The metal welded, the type of weld, type of electrode metal, tensile strength, hardness (Rockwell), fatigue resistance, and corrosion resistance compared to mild steel are indicated. WHB (7b)

Welded Joints for Oil-well Casing. MARVIN COOK (Humble Oil & Refining Co.) *Preprint Am. Petroleum Inst.*, May 1936, 10 pp. *Oil Gas J.*, Vol. 35, May 28, 1936, pp. 33-34, 37-38, 41. The development of deeper drilling establishes a trend toward the use of casing of smaller diameter, the safe depth of which is limited by the joint rather than the collapse strength. This condition will permit the use of a thinner wall to resist collapse, but in turn it will require a joint of higher efficiency in tension than than of the regular A. P. I. design. The possibility of welded joints for casing is discussed and considered as entirely possible, the strongest argument in its favor being the economic one. VVK (7b)

Welding of High-strength Boiler Steels (Die Schweissung von Kesselbaustöhlen höherer Festigkeit) H. AYSSLINGER. *Wärme*, Vol. 60, Apr. 3, 1937, pp. 220-225. Original research on welded Mn and Si-Mn boiler plates of 44-52 kg./mm.^{2} tensile strength. Bending, impact and tensile tests at room and elevated temperatures showed no inferior properties of the weld. Microphotographs are given. EF (7b)

Electric Welding in Rolling Stock Repairs. F. MILLS (Western Australian Govt. R'ways) *Commonwealth Eng.*, Vol. 24, Feb. 1, 1937, pp. 239-241. Describes some remarkable welding jobs in repair and reclamations. An interesting adaptation was the rapid conversion of ordinary steel railway trucks into water tank wagons to cope with the necessities of a severe dry spell. EF (7b)

Resistance Welding Problems—A Plea for Training and Research. JAMES L. MILLER. *Welding Ind., London*, Vol. 5, Mar. 1937, pp. 51-52. General discussion of unwise uses of welding machines of smaller capacity than required. WB (7b)

Effects of the Kind of Sheet and of Subsequent Treatment of the Welded Seam on the Properties of Welds on KS-Seawater Sheets (Einfluss der Blechart und Nachbehandlung auf die Eigenschaften von Schweissungen an KS-Seewasser-Blechen) M. MEIER (I. G. Farbenindustrie A.G.) *Autogene Metallbearbeit.*, Vol. 30, Apr. 1, 1937, pp. 97-102. Original research. Welds on KS-light metal with oxy-acetylene flame were investigated. The strength of all welds was equal to that of the soft-annealed sheet independent of the original hardness of the sheet. A slight increase of strength can be obtained by subsequent rolling (similar to a skinpass mill process). Ha (7b)

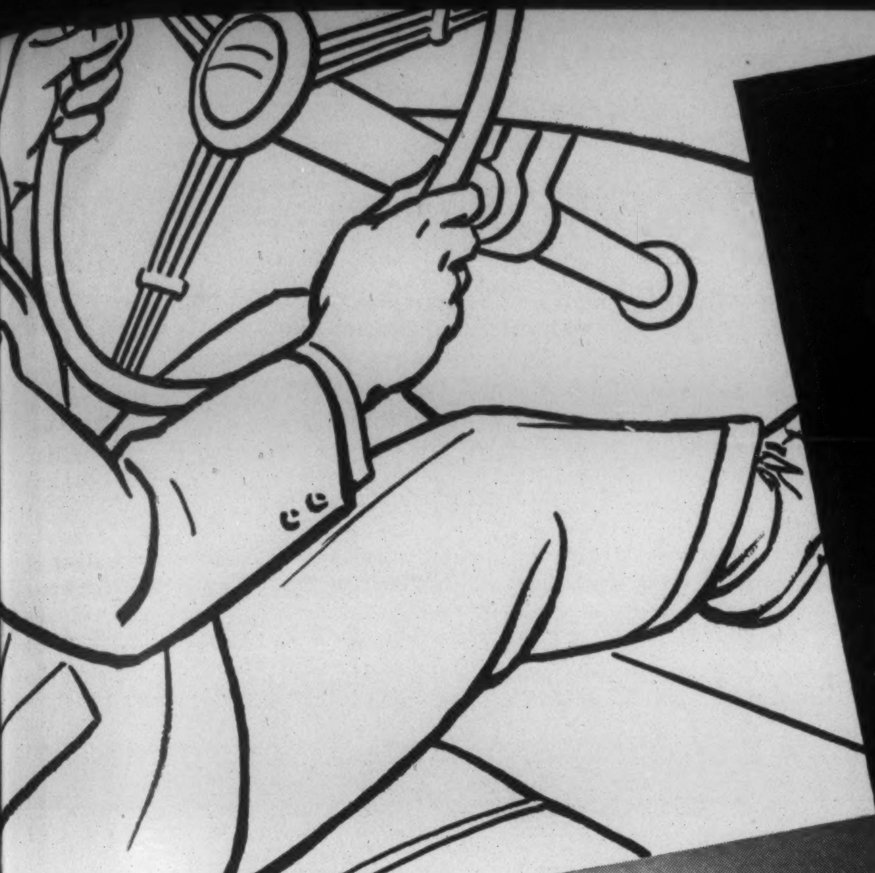
Determination of the Residual Strains and Stresses in Arc-welded Plates. H. E. LANCE. *N. E. Coast Inst. Engs. Shipbldrs.*, Advance copy, Apr. 1937, 29 pp. Results of exact experimental studies are discussed and methods used in measurement of stresses described. Edge welds are made on annealed, mild steel plates, and changes in 2" gage length, placed on both faces of plate before welding, were determined after welding and after partial or complete release of residual strains. The same measurements were carried out for single Vee, three pass, butt welded joint all welding tests being for unrestrained movement of the material during welding except for the Vee, butt weld which was restricted. The cause of distortion in welding is visualized as restricted compressive stresses set up in heating becoming residual tensions due to restricted tensile stresses on cooling. Curves for residual strains versus distance from weld are given showing region of elastic strain starting approximately 1½ in. from welded edge, for some of the plates part of the curves show linear variation of strain with distance from welded edge. It is suggested that the use of the restricted, butt weld design used for the tests together with measuring technique employed will be of practical value for determining suitability of electrodes, parent metal as also welder qualification and welding process at low cost and high precision. WB (7b)

Welding Stainless Steel. JOHN J. MACKINNEY. *Radio Eng.*, Vol. 17, Apr. 1937, pp. 10-12. A description of the "Shotweld" process of spot welding. Stainless steel applications in radio sets are indicated. WHB (7b)

Application of Electric Arc Welding to Steel Structures and Machine Units. R. W. MACBRIDE. *Welder*, Vol. 9, Feb. 1937, pp. 42-52. General review with details of welded structures, e.g. housing for electric drive of 30 in. rolling mill, gear stand and housing and other large structures, which are illustrated. WB (7b)

Keeping the Steel Mill Rolling. L. J. GOULD (Bethlehem Steel Co.) *Ind. & Welding*, Vol. 10, Apr. 1937, pp. 17, 55-57. Brief survey of high spots in rolling mill maintenance with welding rod. Journal bearing sets built up, hard facing and repair of broken parts where equipment must be back in service in short time are imperative uses. Developed uses of welding are in repair of C cast steel put on open-hearth charging machine, joining of cast steel and forged sections, revising rolling equipment by change of minor parts, weight reduction over wooden or riveted scaffold structures. Welding replaced castings which could not be designed for gradual changes in section. Welded construction superior to riveted in combatting corrosion since riveted joints cannot be easily repainted in crevices where corrosion can proceed while weld construction does not catch dirt or accumulate corrosive solutions due to streamline joints. Better heat transfer is claimed for butt weld joint than riveted joint for blast furnace stove (22 ft. diam. shell) to 5 ft. diam. hot blast line. WB (7b)

Railroad Tracks and Autogenous Welding (Schienenwege und Autogenschweissung) H. FRANKENBUSCH. *Autogene Metallbearbeit.*, Vol. 30, Mar. 1, 1937, pp. 66-71; Mar. 15, 1937, pp. 81-87. Maintenance and repair of railroad and street car tracks by building-up worn places, local heat treatment, repair of frogs, switches, etc., by oxy-acetylene welding and the materials employed as welding rod are discussed exhaustively and procedures illustrated by photographs. Ha (7b)



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Some Tensile Tests of Weld Metal at Varying Temperatures. T. R. B. SANDERS. *Welder,* Vol. 9, Feb. 1937, pp. 38-41. Original research on all-weld metal for temperatures of 15°-700° C. Table gives approx. elastic limit, max. load, total elongation and up to point of max. load, neck-diameter after fracture for the various testing temperatures. British standard sample used for metal deposited from Murex, Cresta electrode and tested in author's tensile machine built for uniform rate of loading. Stress strain diagrams for all samples indicate presence of residual stress which is considered as reason for lack of definite yield point. Highest breaking load found for test at 240° C. and temperature increase thereafter consistently decreases strength. Extension up to point of max. load also falls off consistently with temperature increase. WB (7b)

Making Resistance Welds with Separate Twin Electrodes. E. F. ROSS (Staff) *Steel,* Vol. 100, Apr. 5, 1937, pp. 36-38, 72. Describes spot-welding unit developed by the American Coach & Body Co., Cleveland O. Separate cables supply current from a new type of transformer, 1 electrode being merely a ground connection, while other has a pointed tip and control switch. On 16-gage and lighter sheets, correctly timed welds may be made within a 6-ft. radius from ground electrode, without requiring excessive pressure by operator. MS (7b)

Use of the Oxy-acetylene Process in the Coal Mining Industry. G. S. JENKINS (The Consolidated Coal Company) *Mining Congr. J.,* Vol. 23, Mar. 1937, pp. 34-35, 37. A saving of 25 to 50% of the original cost is made by reclaiming shafts, frames, and other large pieces of mining equipment. In a job of this kind it is not uncommon to have some 50 lbs. or more of welding rod used on a single casting. One of the outstanding applications has been the use of hard surfacing materials, for equipment such as cutter bits, tools, chain guides, etc. Another important use of the oxy-acetylene equipment is for bonding and welding rails underground. BHS (7b)

Making a Mounting for the 200 Inch Telescope. *Welding Eng.,* Vol. 22, May 1937, pp. 28-30. WB (7b)

Technical Aspects of Oxy-acetylene Welding. *Engineer,* Vol. 163, Apr. 2, 1937, p. 395. Descriptive. Deals with 3 variations of upward vertical methods of welding. LFM (7b)

Schenectady's New All-welded Armory Rises. *Iron Age,* Vol. 139, May 20, 1937, pp. 48-49. Brief illustrated description of welding procedure. VSP (7b)

Electric Welding Installation and Organization in Shipyards. W. L. FAERMAN. *Welder,* Vol. 9, April 1937, pp. 107-106. *Welding Ind., London,* Vol. 5, Apr. 1937, pp. 87-91. Descriptive. WB (7b)

Theoretical Analysis of Butt Welding of Pipe. S. BORISOV. *Teoria i Pract. Met.,* No. 1, 1937, pp. 56-64. In Russian. Mathematical. (7b)

Light Construction by Welding (Leichtbau durch Schweissen) W. ADRIAN. *Autogene Metallbearbeit.,* Vol. 30, May 15, 1937, pp. 150-153. Advantages in construction of trains, large halls, hangars, etc. are described. Ha (7b)

Application of Autogenous Welding in the Construction of Road Vehicles (Anwendung der Gasschmelzschweissung beim Bau von Strassenfahrzeugen) W. ANDERS. *Autogene Metallbearbeit.,* Vol. 30, May 1, 1937, pp. 138-140; May 15, 1937, pp. 147-149. Advantages are discussed and examples of chassis, trailers, supports, described. Ha (7b)

Overlays Versus Castings of Wear-resistant Alloys. MILES C. SMITH. *Am. Machinist,* Vol. 81, May 19, 1937, pp. 415-417. The question of economy in the use of various types of welded overlays or a solid casting is discussed. The choice depends on the physical and chemical properties which will best satisfy the requirements of a special case. A few examples illustrate the problem. Ha (7b)

Effect of Heat on Iron and Steel—Some Basic Facts for the Beginner in Welding Engineering. E. D. SODERSTROM. *Welding Engr.,* Vol. 22, June 1937, pp. 18-21. Elementary, lucid discussion of allotropy. WB (7b)

Chrome-vanadium Crankshaft Repair. JOHN RAJAN (Meriam Co.) *Ind. & Welding,* Vol. 10, May 1937, pp. 30-31. Shaft 12 ft. long, 1 ton weight, repaired by Veeing out broken section with torch, chipping torch-cut surface with air hammer and chisel and welding. WB (7b)

Training Welding Operators. C. T. RAYMO (Chattanooga Boiler & Tank Co.) *Ind. & Welding,* Vol. 10, May 1937, pp. 21-23. Elementary and practical discussion. WB (7b)

All Welded Tramcar Underframes. *Welder,* Vol. 9, Apr. 1937, pp. 120-121. Description, plus photos. WB (7b)

Control System for Spot Welding. *Steel,* Vol. 100, June 28, 1937, p. 45. Describes laboratory welder which is applicable to a wide range of welding conditions and provides accurate readings of the welding variables. MS (7b)

Sheet Metal Welding. *Ind. & Welding,* Vol. 10, May 1937, pp. 18-20. Use of jigs for controlling distortion and localizing heat in light gage sheet is discussed with sketches. WB (7b)

All-welded Intermediate Floor for Heavy Workshop Load. *Engineering,* Vol. 143, Apr. 2, 1937, pp. 369-370. General description, giving diagrams and illustrations. LFM (7b)

A. B. C.'s of Manganese Steel Welding. B. H. PAYNE (Stuly-Sickles Co.) *Ind. & Welding,* Vol. 10, May 1937, pp. 28-29. Question and answer article summarizing Mn steel information for operating welder. WB (7b)

Golden Gate Bridge. E. L. MATHY (Victor Equipment Co.) *Welding Engr.,* Vol. 22, June 1937, pp. 22-25. Descriptive article shows where cutting and welding were used in construction. WB (7b)

Copper Boilers (Les Travaux de Chaudronnerie) P. HOLLARD. *Cuivre et Laiton,* Vol. 10, Mar. 30, 1937, pp. 137-139. Oxy-acetylene welding of Cu vessels, tanks etc., is discussed as to preparation of work and procedures. Ha (7b)

Welded Rails. *Engineering,* Vol. 143, Jan. 22, 1937, p. 96. Editorial commenting on a report by Dr. Muller published in the Nov. 1936 *Bull. Intern. Railway Cong. Assoc.* LFM (7b)

All Welded Steel Omnibus Bodies. *Welder,* Vol. 9, Mar. 1937, pp. 84-87. Discussion of fabrication of all steel bus by Park Royal Coachworks Ltd. WB (7b)

Flexible Welder Facilitates Truck Fabrication. *Iron Age,* Vol. 139, May 20, 1937, pp. 45-47. Considers the use of welding in motor truck fabrication by the Am. Coach & Body Co. Cleveland, VSP (7b)

Boiler and Pressure Vessel Inspectors Review Developments in Welding. *Steel,* Vol. 100, May 31, 1937, pp. 52, 54. Summary of meeting of the National Board of Boiler and Pressure Vessel Inspectors. Includes abstracts of papers presented. MS (7b)

New Articulated Trains for Long Distance Excursion Traffic. L. M. S. R. *Welder,* Vol. 9, Apr. 1937, pp. 99-101. WB (7b)

The Sleeve Electrode for the Arc-welding of Copper. A. MATTING & W. LESSEL. *Welding Ind., London,* Vol. 5, Mar. 1937, pp. 63-66; Apr. 1937, pp. 93-97. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 364R/8. WB (7b)

Welding and its Application to the Mining and Metallurgical Industries. C. R. WHITTEMORE. *Trans. Can. Inst. Mining Met.,* Vol. 39 (in Can. Mining Met. Bull. No. 296, Dec. 1936) pp. 782-824. A detailed description of oxy-acetylene and metallic-arc welding of various metals, welding alloy steels, and hard facing. AHE (7b)

7c. Riveting

Use of Austenitic Welding Rods with Non-austenitic Steels (Verwendung von Schweissdrähten, die austenitisches Gefüge ergeben, für die Schweissung unlegierter und niedriglegierter (nichtaustenitischer) Stähle) K. L. ZEYEN. *Autogene Metallbearbeit.,* Vol. 30, May 1, 1937, pp. 130-138. Review. Welding rods containing 18% Cr and 8% Ni, and 25% Cr and 20% Ni gave welds of excellent strength and toughness. Examples of welds made and test results are shown. For best results the flame, when oxy-acetylene is used, should be neutral and the welding rod must not "puddle" the melt. For electric welding, only coated welding rods can be used and unusually thick pieces must be preheated. The current should be, for electrodes of 3 mm., 80-90 amp.; 4 mm., 110-120 amp.; 5 mm., 135-145 amp.; 6 mm., 155-170 amp. Ha (7c)

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8. FINISHING

H. S. RAWDON, SECTION EDITOR

Finishing Operations Account for Almost Half of Plow Production Cost. *Steel,* Vol. 101, July 26, 1937, pp. 54, 56, 64. Describes grinding, polishing, and painting of plow parts in plant of the Syracuse Chilled Plow Co., Syracuse. MS (8)

8a. Pickling

Application of Corrosives to Copper and its Alloys (Le Travail du Cuivre et de ses Alliages par les Corrosifs) A. CHAPLET. *Cuivre et Laiton,* Vol. 10, Mar. 30, 1937, pp. 129-136. A brief historical sketch is given of etching and other corrosive effects on Cu and brass for industrial and artistic use, and technical terms in connection therewith defined (according to French usage). The particular properties of several agents and the mode of application is described in full. 13 references. Ha (8a)

The Effect of Pickling on the Mechanical Properties of Steel. KOSUKE KIKUCHI (Japan Steel Tube Co.) *Tetsu-to-Hagane,* Vol. 23, Apr. 25, 1937, pp. 348-353. In Japanese. Original research. The change of tensile strength and elongation of low-carbon steel tubes, small in diameter, which were pickled in acid solutions of various concentrations and at different temperature, was determined. The results are summarized as follows: (1) Steels pickled in acid solution show an increase in tensile strength and a decrease in elongation. (2) Acid brittleness of pickled steel can, to a certain extent, be prevented by the use of some inhibitors. (3) Acid brittleness is eliminated by heating the pickled steel at a relatively low temperature or by holding it at room temperature for several days. NS (8a)

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8b. Cleaning including Sand Blasting

High-speed and Close Control Feature New Lines for Cleaning Cold Strip. M. STONE (United Engineering & Foundry Co.) *Steel,* Vol. 100, June 14, 1937, p. 54-56. Describes commercial use of an electrolytic cleaning line for removal of oil from cold-rolled strip at speeds in excess of 900 ft./min. Comprises an uncoiler; seam-type electric welder for joining ends of coils; power washer for removing major portion of oil by high-pressure sprays of hot cleaning solution; rotary scrubbing brushes; electrolytic tank in which work is cathode, with anodes above and below strip; scrubber; hot-rinse tank; and wringer rolls for drying strip. Material is pulled through line against a controlled back tension by a set of pinch rolls ahead of wringer rolls. MS (8b)

Degreasing Before Metal Cleaning. *Chem. Trade J.,* Vol. 101, July 9, 1937, p. 30. Describes trichlorethylene process in electroplating. MS (8b)

8c. Polishing & Grinding

Surface Defects and Their Importance on the Practical Behavior of Metallic Materials (Difetti superficiali e lora importanza nel practico comportamento dei materiali metallici) V. S. PREVER. *Ind. Meccan.,* Vol. 19, May 1937, pp. 316-321. Surface qualities obtained in modern finishing processes, together with methods and instruments for the determination of smoothness of surfaces are described. The connection between degree of fineness and tendency to develop surface defects is correlated with service behavior. 6 references. Ha (8c)

8d. Electroplating

Plating Copper, Nickel and Zinc Alloys from Cyanide Baths. C. L. FAUST. *Metal Cleaning Finishing,* Vol. 8, June 1936, p. 319, 6 pp. The electrodeposition of a ternary alloy of Cu, Ni and Zn is discussed from the standpoint of the cathodic process. Solutions used were as follows:

	1.	2.
Copper cyanide	2.41	0.60 oz./gal.
Nickel cyanide	1.92	4.08 "
Zinc cyanide	0.77	0.19 "
Potassium cyanide	4.80	4.80 "
Potassium carbonate	0.53	0.53 "

Effects on the deposit of different variables such as current density, temperature, metal ratio and anodes are discussed with curves and experimental data. GBH (8d)

Permanent Colors Produced Electrolytically on Metal Surfaces Without Aid of Pigments. *Steel,* Vol. 100, Mar. 22, 1937, pp. 56-57, 73. Practical description of patented process (Jesse E. Stareck, Brit. Patent 452,464, U. S. Patent 2,059,053). Metal article is made cathode in an alkaline electroplating bath, which produces a thin film which shows in succession different interference colors with increasing film thickness. Desired color is obtained by arresting process at proper film thickness. On plated Cu, colors are produced directly in bath but with plated Fe, Co, or Ni, subsequent baking operation is required to bring out color. MS (8d)

A New Phenomenon Observed in a Cell with one Electrode Polished. Role of the Beilby Layer (Sur un Nouveau Phénomène Observés dans les Piles dont une Électrode est Polies. Rôle de la Couche de Beilby). ALBERT GRUMBACH & FÉLIX TABOURY. *Compt. Rend.,* Vol. 204, Apr. 19, 1937, pp. 1178-1179. A Au or Pt electrode with a polished surface gives a different e.m.f than the usual drawn or cast metal electrode. FHC (8d)

Structure of Electrolytic Cr (La Structure du Chrome Électrolytique). MICHEL CYMBOLISTE. *Comp. Rend.,* Vol. 204, May 31, 1937, pp. 1654-1656. Original research. Photomicrographs show the microstructure of Cr plate in relation to different conditions during electrodeposition. FHC (8d)

Throwing Power and Current Distribution in Plating Baths. L. C. FLOWERS. *Metal Cleaning Finishing,* Vol. 8, Sept. 1936, pp. 571-576; Oct. 1936, pp. 683-686; Nov. 1936, pp. 767-770. Review of investigations on throwing power in electroplating. The various solutions are discussed with curves and some experimental data are given. Effects of different variables in most solutions on the throwing power of the baths are noted. 30 references. GBH (8d)

Plating to Specifications. F. C. MESLE. *Metal Cleaning Finishing,* Vol. 8, July 1936, pp. 387-392. Trade note. One of the most important recent advances in the field of electrodeposition is the control of quality of the plate by specifications. A procedure for plating to specification is described. GBH (8d)

Electroplaters Review Technical Progress at Twenty-fifth Convention. *Steel,* Vol. 100, June 21, 1937, pp. 75, 78. Report of meeting of Am. Electro-Platers' Soc. Includes abstracts of some papers. William Blum outlined results of exposure tests of plated coatings on Cu, brass, Zn, and Zn-base die castings. Albert Brenner described a non-destructive test for determining thickness of Ni coatings on non-magnetic metals. Walter R. Meyer described European electroplating practice. MS (8d)

8e. Metallic Coatings other than Electroplating

Metal Spraying. L. F. CHAMBERS (G. A. Harvey & Co.) *Engr. of India,* Vol. 5, May 1937, pp. 5-6. Lecture on metal spraying by the "metallization" process. APS (8e)

Metal Spraying: Processes and Some Characteristics of the Deposits. E. C. ROLLASON. *Engineer,* Vol. 163, Mar. 19, 1937, pp. 328-329. *Engineering,* Vol. 143, Mar. 19, 1937, p. 323; *Iron & Coal Trades Rev.,* Vol. 134, Mar. 12, 1937, p. 492. **Metal Spraying—Processes—Properties of Deposits—Chemical Engineering Applications.** E. C. ROLLASON & J. W. HISHON. *Can. Chem. Met.,* Vol. 21, Apr. 1937, pp. 130-132, 134. Includes discussion. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 435R/3. LFM + Ha + WHB (8e)

Hydraulic Repair Practice. T. C. STAVERT (Southern Calif. Edison Co.) *Electrical West,* Vol. 78, June 1937, pp. 67-68. Includes discussion of use of metal spraying for building up and maintenance of parts of hydraulic generation equipment. MS (8e)

Alloys in the Zinc Bath. G. A. BRAYTON. *Metal Ind.,* New York, Vol. 34, Sept. 1936, pp. 336-337. See *Metals and Alloys,* Vol. 7, Nov. 1936, p. MA 539L/3. CBJ (8e)

8f. Non-Metallic Coatings

Properties and Applications of Protective Phosphatic Coatings (Proprietá e applicazioni dei rivestimenti protettivi fosfatici) O. MACCHIA. *Ind. Meccanica,* Vol. 19, Mar. 1937, pp. 163-170. A general review of methods, procedures and patents, on the protection of ferrous metals by phosphate coatings. 38 references. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 162L/6. Ha (8f)

Surface Treatment of Magnesium Alloys (Die Oberflächenbehandlung von Magnesiumlegierungen) H. REININGER (Metallgussgesellschaft, Leipzig) *Metallwaren- Ind. Galvano-Tech.,* Vol. 35, Jan. 15, 1937, pp. 41-42; Feb. 1, 1937, pp. 63-66; Feb. 15, 1937, pp. 99-103. Comprehensive review, mostly of patent literature. 51 references. EF (8f)

Metal Coloring. M. deK. THOMPSON. *Metal Cleaning Finishing,* Vol. 7, Sept. 1935, pp. 433-436. Brief practical review. Natural Cu patina, now considered to be the basic sulphate, $CuSO_4.3Cu(OH)_2$, is best known color on metal. An artificial patina on Cu is obtainable by brushing on a solution consisting of H_2O 3 qts., HCl 1 qt., verdigris 3 lbs., $CuCO_3$ 1 lb., powdered arsenic ½ lb., NH_4Cl 3 lbs. Each application is allowed to dry 2 to 3 days and application continued to desired shade. The following solution applied by spraying in 5 operations with intermediate drying for 15 min., also produces a patina; 90 lbs. ammonium (salt not stated), 3 lbs. $CuSO_4$, 1 lb. 3 ozs. conc. NH_4OH, 100 gal. H_2O. Bronze colors are produced on Cu by heating in a sand bath or in a mixture of Fe oxide and graphite. Steel is blackened by immersion in a fused (932° F.) mixture of Na and K nitrates, plus ½% by vol. of MnO_2. Black is produced on Cd by immersion in a solution consisting of 60 g. $KClO_3$, 25-30 g. $CuSO_4$, 1 l. H_2O and a brown on Cd by immersion in solution containing 10-15 g. $Cu(NO_3)_2$, 2.5 g. $KMnO_4$, 1 l. H_2O. 13 references. GBH (8f)

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9. TESTING

Die-cast Metals and Alloys. Report of A.S.T.M. Committee B-6. J. R. Townsend, Chairman. *Am. Soc. Testing Materials.* Preprint for June 1937 meeting, 7 pp. Progress report. Subcommittee III is to determine tensile strength, creep, impact and hardness of 5 Sn-base and Pb-base alloys. Subcommittee V will add 3 Zn-base alloys and 2 Mg-base alloys to its exposure and corrosion tests. For previous report see *Metals and Alloys,* Vol. 8, June 1937, p. MA 377R/2. VVK (9)

Two Approved Connections of Universal X-ray Apparatus for Testing Materials (Ueber zwei bewährte Schaltungen von Röntgen-Universalapparaten zu Materialprüfungszwecken) F. Regler. *Mitt. Tech. Versuchsamtes,* Vol. 25, 1936, pp. 20-31. Descriptive. With a discussion of the principles of X-ray radiography and diffraction and of X-ray spectroscopy, a stationary and a portable installation of an X-ray apparatus is described which can be used equally well for all three purposes. Voltages up to 220 kw. are applied. Ha (9)

9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

Cracking of Plates. S. G. Afanasev & K. F. Starodubov. *Teoria i Pract. Met.,* No. 1, 1937, pp. 65-74. In Russian. Original research. In one of the plants of southern Russia usual loss due to cracking of plate is 11% reaching sometimes 40%. Cracking is 0.5-1.0 mm. deep and is found usually on sheets made from the bottom portions of ingots. An extended investigation, which is described, failed to establish any relation between the appearance of the surface, heating rate, rolling practice and the composition of the metal and the defect. Cracking was greatly reduced by bottom pouring of ingots. Plain C steel was studied. (9a)

Locomotive-tyre Failures. *Engineering,* Vol. 143, Mar. 12, 1937, p. 292. Editorial commenting on the report of the Committee on Locomotive Construction presented before the 1936 Annual Meeting of the Assoc. Am. Railroads. Discusses various defects causing tire failure such as: shelling, which is a fatigue type of failure; defects due to improper heat treatment; cracks in the bore from rough tool marks; nicks and corrosions; and welding and torch burns. LFM (9a)

9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

Application of Tension-impact Tests. G. F. Jenks (Ordnance Dept., U. S. Army) *Trans. Am. Soc. Mech. Engrs.,* Vol. 59, May 1937, pp. 313-318. Causes of errors in notch-impact testing are explained and tests are described that show that tension-impact tests give more satisfactory results. Impact strength of materials, within certain limits of velocity, is a derived value, while transition velocity is a fundamental property of metals and means that velocity of loading beyond which the energy to rupture the material is no longer constant. In tension-impact tests, this critical velocity can be separated from the impact strength. Examples illustrate the application of the method. Ha (9b)

Testing Structural Stability in Industry (Gestaltfestigkeitsversuche der Industrie) S. Berg. *Z. Ver Deut. Ing.,* Vol. 81, Apr. 24, 1937, pp. 483-487. The importance of carrying out tests to determine the resistance of materials or structures against deformation under dynamic conditions is emphasized, and present methods and apparatus reviewed. Ha (9b)

Stress-optically Less Sensitive Materials in Photoelasticity. A. G. Solakian (Columbia Univ.) *Mech. Eng.,* Vol. 59, June 1937, pp. 423-424. Original research. The optical effectiveness and relative sensitivity of transparent materials used for photoelastic investigations was determined. It is recommended to use, for problems of intricate design, 2 separate models of exactly similar dimensions but of 2 different materials, according to whether the intensity of stress or the direction of stress is to be determined. The methods are described in detail. Ha (9b)

9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

The abstracts appearing under this heading are prepared in cooperation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

Dependence of Repeated Bending Strength on Size of Specimen and Type of Notch (Gesetzmässige Abhangigkeit der Biegewechselfestigkeit von Probengrosse und Kerbform) W. Kuntze & W. Lubimoff. *Arch. Eisenhüttenw.,* Vol. 10, Jan. 1937, pp. 307-311. For similar notch conditions similar results are obtained on large and on small specimens. **Effect of Stresses Arising from Shape of Specimen on the Repeated Bending Strength (Einfluss des durch die Gestalt erzengten Spannungszustandes auf die Biegewechselfestigkeit)** W. Kuntze. *Ibid,* Feb. 1937, pp. 369-373. Methods of determining the stress distribution in variously notched fatigue specimens are discussed. Such determinations may be used as a means of extrapolating from results on small specimens to those on large. SE (9c)

Report of the Research Committee on Fatigue of Metals. *Preprint, Am. Soc. Testing Materials,* 1937. A summary of current investigations in progress includes tests of full-size structural and machine parts, fatigue failure of riveted joints, fatigue failures under localized compression (gear teeth and railroad rails under car wheels), sheet metals for airplanes, and "size effect" in fatigue specimens. Problems needing study included comparison of results of axial tests and flexure tests, and study of the shape of the upper branch of the S-N diagram. Two systems of nomenclature for range of stress in fatigue were described, and in the discussion a third was mentioned. HFM (9c)

A Fatigue Machine for Testing Metals at Elevated Temperatures. F. M. Howell and E. S. Howarth. *Preprint Am. Soc. Testing Materials,* 1937. Improved apparatus. The specimen used is part of a cantilever beam, one end of which is fixed in an electrically heated furnace. The specimen is entirely within the furnace, but the cantilever beam assembly extends outside the furnace, and its outer end is revolved by a variable-throw eccentric at 3600 r.p.m. The specimen is its own dynamometer, and the method of calibrating each specimen is described. The method of temperature control is also described. A discussion of various sources of error in stress determination is given and the maximum error is estimated at ±3%. HFM (9c)

Fatigue Properties of Metals Used in Aircraft Construction at 3450 cycles and 10,600 cycles. T. T. Oberg and J. B. Johnson. *Preprint, Am. Soc. Testing Materials,* 1937. Original research. Using ball-bearing rotating-beam testing machines operating at 10,600 r.p.m. tests were made on three alloy steels, Inconel, and two aluminum alloys. Corresponding tests were made at 3450 r.p.m., and a few tests at 1750 r.p.m. Both plain and notched specimens were tested. The values of the fatigue limits were not appreciably affected by this range of speed. The temperature rise in the critical section of specimen increased with an increase of speed of machine, but the fatigue limit was not appreciably affected. HFM (9c)

9e. Spectrography

G. R. HARRISON SECTION EDITOR

The Spectrographic Determination of Magnesium in Aluminum Alloys. W. R. Koch. *Proc. Am. Soc. Testing Materials,* Vol. 36, Pt. II, 1936, pp. 292-298, discussion pp. 299-300. Descriptive. In order to compare the results of Mg determinations in Al alloys by several spectrographic methods utilizing metallic electrodes, objective photometric measurements of the spectrograms were made photoelectrically. The effect of the presence of approx. 1% of Cu, Fe, Mn, or Si on the spectrographic determination of Mg in Al alloys is negligible. Comparison of the results obtained from spectrum line pairs composed of two spark lines with results obtained from combinations of arc and spark lines indicates that pairs consisting of like lines are more suitable for analytical purposes. The spark method is satisfactory for routine analysis where an accuracy of ±10% of the amount present over a range of concentration from 0.1 to 4.0% is sufficient. VVK (9e)

10. METALLOGRAPHY

The Thickness of Oxide Films on Iron. H. A. MILEY (Cambridge Uni.) *Iron & Steel Inst., London, Carnegie Schol. Mem.*, Vol. 25, 1936, pp. 197-212. Original research. The thickness of oxide films was determined by measuring the millicoulombs necessary for their cathodic reduction, and the method gives good results compared with other methods. The apparent discrepancy previously obtained between gravimetric and optical results is explained as being due to an invisible oxide film carried by the specimen at the time of the first weighing. The new electrical method has been used to measure the rate at which an Fe oxide film thickens when the Fe is exposed to dry air for various periods after abrasion. The results suggest a rapid rate of oxidation for a short time followed by a relatively slow rate of oxidation. The rate of oxidation is influenced by temperature changes, effective area, and cracking of the film resulting from abrasion or other treatment. Vernon's observation that no bright colors appeared on Fe below 200° C.—even when the amount of oxidation was sufficient to have caused colors at higher temperatures—was confirmed. The author believes that the oxide formed above 200° C. is α-Fe_2O_3 (hexagonal structure), and the oxide formed below 200° C. is γ-Fe_2O_3 (cubic structure). If the γ-Fe_2O_3 is in optical continuity with the Fe, it will afford no adequate lower reflecting surface, whereas, if the α-Fe_2O_3 is crystallographically discontinuous with the Fe, it will provide the conditions necessary for interference. 26 references. CW (10)

Identification of Phases of Fe-Pd Alloys by Magnetic Studies and X-Ray Measurements (Identification de Diverses Phases par l'Étude Magnétique et les Rayons X dans les Alliages de Fer et de Palladium). RAYMOND HOCART & MAURICE FALLOT. *Compt. Rend.*, Vol. 204, May 19, 1937, pp. 1465-1467. Original research. A description is given of the phases observed in alloys of the Fe-Pd system by means of magnetic analysis and X-ray measurements. FHC (10)

Magnetic Investigation of. Precipitation Hardening (Magnetische Untersuchung der Ausscheidungshärtung) HERMANN AUER. *Z. tech. Physik,* Vol. 16, Nov. 1935, pp. 486-488. Original research. Quantitative determination (with an accuracy of 0.2%) of the magnetic susceptibility of pure metals and alloys within the temperature range from 0°-600° C. constitutes an accurate and convenient method for the study of changes in their constitution during heat treatment. Room-temperature susceptibility measurements on alloys of varying composition quenched from various temperatures permit accurate determination of solubility lines in phase diagrams and of the formulas of the precipitating compounds. High-temperature susceptibility measurements enable one to follow closely the processes of atomic rearrangement preceding precipitation proper during precipitation hardening. The application of the method is demonstrated on binary Al-Cu alloys with up to 5% Cu. See *Metals and Alloys,* Vol. 6, Apr. 1935, p. MA 163R/1. ORS (10)

The Constitution of the Alloys of Silver, Tin, and Mercury. MARIE L. V. GAYLER (Nat. Physical Lab.) *J. Inst. Metals,* Vol. 60, 1937, Advance Copy No. 766, 21 pp. Original research. The constitution of the Ag-Sn-Hg system, except for a small range of composition near the Sn corner, was determined by thermal and microscopic methods. Five invariant reactions were found and two others were deduced from experimental and theoretical evidence. The invariant reactions starting from the Sn corner and their temperatures are:

Reaction	Temperature, ° C.
$\gamma + \alpha_2 + \text{liq.} \rightarrow \gamma + \beta_2$	Between 217 and 221
$\gamma + \beta_2 + \text{liq.} \rightarrow \gamma + \gamma_2$	217
$\gamma + \text{liq.} \rightarrow \beta_1 + \gamma_2$	Probably about 210
$\beta_1 + \text{liq.} \rightarrow \gamma_1 + \gamma_2$	84
$\gamma_1 + \gamma_2 + \text{liq.} \rightarrow \gamma_1 + \delta_2$	80
$\gamma_1 + \delta_2 + \text{liq.} \rightarrow \gamma_1 + \epsilon_2$	—36
$\gamma_1 + \epsilon_2 + \text{liq.} \rightarrow \gamma_1 + \epsilon_2 + \text{Hg}$	—38.8

Isothermal sections for 100, 84, and 70° C. were plotted from experimental data. JLG (10)

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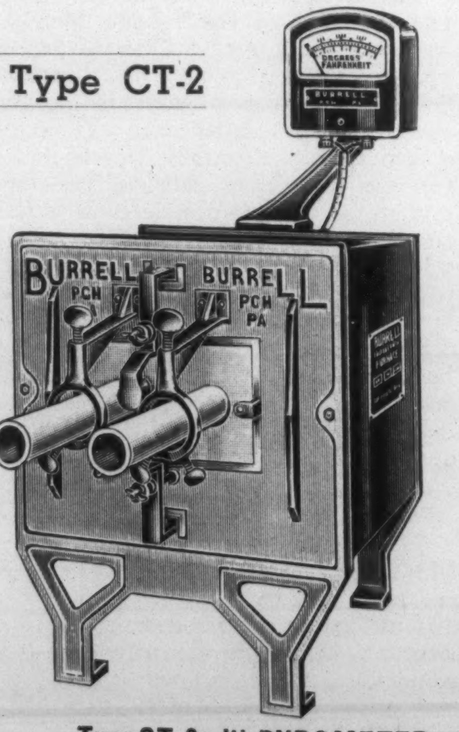

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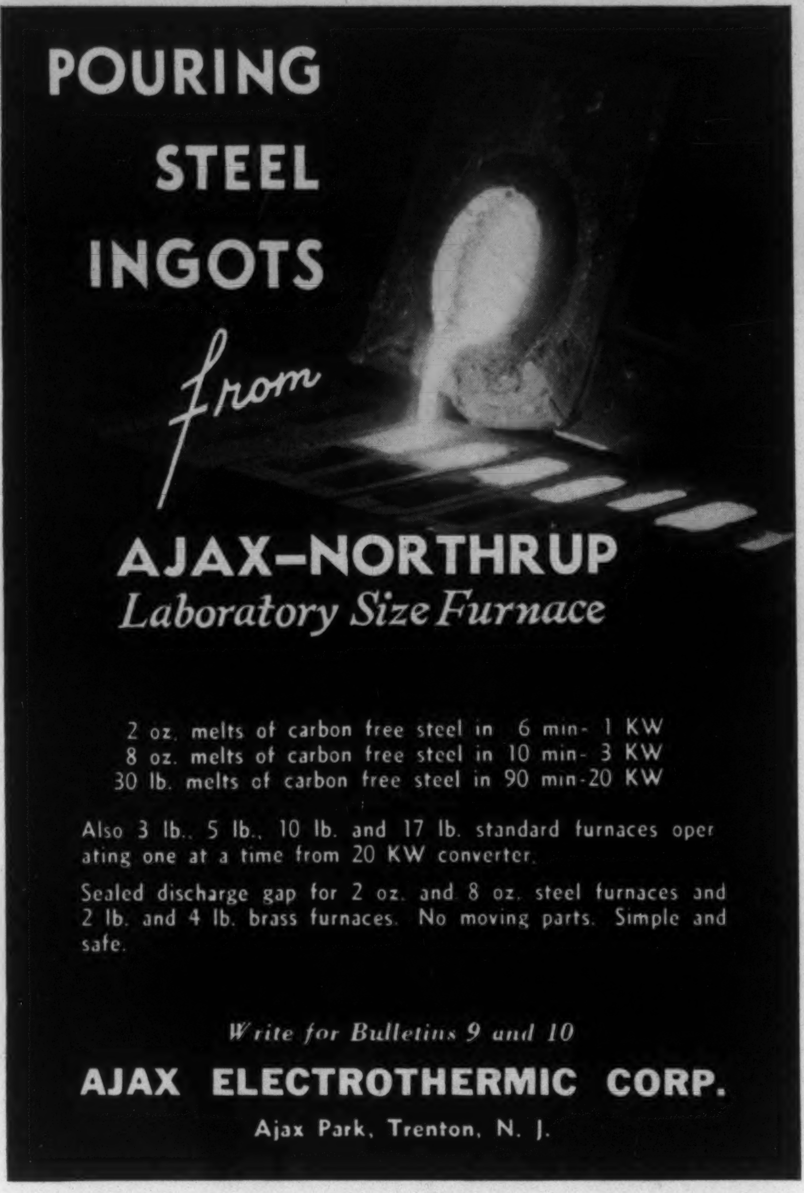
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The Systems Tin-germanium and Tin-beryllium. W. GUERTLER & M. PIRAM (Inst. Ange. Metallkunde) *Tech. Pub. Inter. Tin Research Development Council,* Series A. No. 50, Feb. 1937, 23 pp. Original research. Investigation of the Sn-rich end of the Sn-Ge diagram was made by microscopic examination, thermal analysis, and spectroscopic examination. The diagram for this system apears to resemble closely that of the Sn-Si system. Sn and Ge are completely miscible in the liquid state. On cooling, crystals of Ge are contained in a ground mass of Sn containing from 0.01 to 0.1% Ge. This small amount may be present in solid solution, or heterogeneously as a fine eutectic, or as colloidal particles. Addition of 0.35% Ge doubles Brinell hardness of Sn but decreases its ductility by 20% and its bending strength by 50%. Be dissolves to a small extent in Sn in the liquid state but separates out on cooling, leaving a ground mass that contains only a few tenths % Be as shown by spectroscopic analysis. Addition of 0.2% Be to Sn slightly increases hardness, reduces ductility 20%, and slightly improves bending strength.
BWG (10)

The Symmetry and Crystal Structure of Manganite Mn(OH)O. M. J. BUERGER. *Z. Krist.,* Vol. 95, Nov. 1936, pp. 163-174. In English. A new structural investigation showed that manganite has an arsenopyrite-like structure which is a superstructure based on the marcasite type. Manganite is definitely monoclinic, not orthorhombic. Details are given. See also *Metals and Alloys,* Vol. 8, May 1937, p. MA 295L/10. EF (10)

The Formation of Martensite in Iron-nickel Alloys (Die Ausbildung des Martensits bei Eisen-Nickel) H. BUMM & U. DEHLINGER (Kaiser-Wilhelm Inst. Metallforsch., Stuttgart) *Z. Metallkunde,* Vol. 29, Jan. 1937, p. 29. Original discussion. The transformation from the face-centered to the body-centered cubic lattice is complete below —180° C. for alloys of Fe with 29% Ni, below 20° for 26% Ni, if a virgin single crystal is used. In both alloys a platelike martensite is produced. However, if the crystal has already passed through the transformation cycle, some of the face-centered form is retained at the above temperatures and the martensite is needle shaped. [Structures are more probably determined by the temperature of transformation, G.D.] ["Martensite" here is not to be confused with C-steel martensite. J.S.M.]
GD (10)

X-ray Investigation of Lattice Changes in Plastically Deformed Gold (Röntgenographische Untersuchung der Gitterstörungen in deformiertem Gold) W. BOAS (Eidgenöss. Tech. Hochschule Zürich) *Z. Krist.,* Vol. 96, Mar. 1937, pp. 214-224. Original research. Intensity measurements of X-ray spectra from cold worked (filed) and annealed Au powder disclosed considerable fading of intensity owing to cold working. This cannot be explained by a statistical, random displacement of atoms from their normal lattice positions. The widening of the reflection lines indicates internal lattice stresses of about 37,000 lbs./in.^{2} The following types of lattice changes occur: (1) bending of crystals and twisting of crystal fragments. This effect shows up as asterism in Laue photographs and by the extension of interferences from rotating crystals. These lattice disturbances are not related to strain hardening since bending back into the original position further increases the cold working effect, while the asterism partly disappears. Crystal recovery, which lowers strength and hardness, does not manifest itself in the Laue spots. (2) The crystal becomes elastically distorted, causing the widening of the X-ray lines. (3) Inhomogeneous distortions of the lattice occur, manifesting themselves by a decrease of intensities scattered into the interferences. A direct relationship to strain hardening is assumed. That portion of the energy which remains in the crystal during deformation and which is not transformed into heat, is mainly located in the small, severely deformed regions of the crystal.
EF (10)

The Effect of Heat Treatment, Ageing, and Working upon the Condition of Carbon in Steel. C. L. SHAPIRO (Harvard Univ.) *Iron & Steel Inst., London, Carnegie Schol. Mem.,* Vol. 25, 1936, pp. 141-196. Review and original research. The author first shows that the Eggertz test for determining C in steels colorimetrically may be used to determine in a relative manner the particle size of carbide, and then uses the test in a study of the effect of carbide particle size on results due to heat treating, aging and mechanical deformation of steels. In general the study confirms the conclusions of others using other methods of investigation. From the results of microstructure studies, the author describes (a) the mechanism by which pearlite divorces, (b) the factors that influence the rate of spheroidization, (c) the formation of pearlite from spheroidized cementite, (d) the factors that influence the α-γ transformation, and (e) the mechanism of the α-γ conversion. The term "Sauveurite" is added to the nomenclature to describe any aggregate of steel that may contain either 3 or 4 constituents and is formed during the change from α to γ Fe. 31 references. CW (10)

The Effect of the Addition of Small Percentages of Iron and Silicon to a High-purity 4 Per cent Copper-aluminium Alloy. MARIE L. V. GAYLER (Nat. Physical Lab.) *J. Inst. Metals,* Vol. 60, 1937, Advance Copy No. 763, 23 pp. Original research. Al alloys containing 4% Cu and up to 0.6% Fe, and 1% Si were studied. Small castings were held at 450° C. for 5 hrs., then forged. All were examined microscopically to determine phases present. It was not found possible to approach equilibrium, and the results obtained did not permit the construction of a constitutional diagram. The α (FeSi) and β (FeSi) phases were identified, together with CuAl$_2$ and Si. FeAl$_3$ was not found. Si is held in solid solution to a limited amount at 500° C. and is precipitated during slow cooling to 190° C. CuAl$_2$ was present in some of the alloys heat treated at the higher temperatures but was precipitated in large amount on slow cooling to 190° C. Age hardening was studied by means of Brinell hardness measurements. The addition of 0.1% Fe inhibits aging at room temperature, but not at higher temperatures. Addition of 0.6% Fe reduces, to a marked degree, aging at elevated temperatures. Addition of up to 1.% Si does not inhibit the effect of 0.6% Fe. From a study of the constitution of alloys it would appear that the age hardening that takes place at higher temperatures may be attributed to precipitation of Si as well as some CuAl$_2$.
JLG (10)

A Precision Recording Dilatometer. R. A. ACKLEY & F. M. WALTERS (Metals Research Lab.) *Metals and Alloys,* Vol. 7, Dec. 1936, pp. 314-320. Descriptive discussion. A new differential dilatometer records the dilatation-temperature curve photographically and the time-temperature curve by pen. It can be used between 25° and 1100° C. and is capable of recording differential length changes from 0.00005 to 0.01 in. The specimen temperatures may be kept constant within ± 1° C. or raised or lowered at constant rates of 1/8°, 1/2°, or 2° C. per minute. The authors state that the temperature gradient of the 1 in. specimen can be kept below 1/4° C. GEG (10)

Neuman Bands in Ferrite. C. P. BUNIN. *Metallurg,* Vol. 12, Jan. 1937, pp. 97-99. In Russian. On the basis of study of etching pits of specimens containing Neuman bands it was concluded that the latter occupy (211) position in crystals. (10)

11. PROPERTIES OF METALS AND ALLOYS

The Thermochemistry of Alloys I. Direct Determination of the Heats of Formation of the Alloy Series Cobalt-Silicon, Iron-Aluminum, Cobalt-Aluminum, Nickel-Aluminum, Copper-Aluminum and Antimony-Zinc in the Cast State (Zur Thermochemie der Legierungen I. Unmittelbare Bestimmung der Bildungswärmen der Legierungsreihen Kobalt-Silizium, Eisen-Aluminium, Kobalt-Aluminium, Nickel-Aluminium, Kupfer-Aluminium und Antimon-Zink für den Gusszustand) W. OELSEN & W. MIDDEL. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch, Düsseldorf.* Vol. 19, 1937, pp. 1-26. Original research. The importance of relating the heats of formation of alloys to their chemical behavior and of explaining the affinity of metals in forming alloys is discussed, and the method and apparatus for determining these values are described. The alloys were cast in a crucible and the heats of formation determined with a water calorimeter. The heat content vs. concentration curves of the melts distinctly show the most important compounds in the solid state by discontinuities (maxima, minima, or angular bends). The chemical conditions in forming compounds in the melt are not different in principle from those of the crystallized intermetallic compound and of solid solution. The binary compounds, as shown in the curves, have the following values:

Alloy	Heat of formation in K cal./g. mol.	Alloy	Heat of formation in K cal./g. mol.
Co_2 Si	27.6	Co Al	26.4(32)
Co Si	24.0	Co Al_2	31.8
Co Si_2	24.6	Co_2 Al_5	70.0(86)
Co Si_3	25.6	Co Al_4	38.5
Fe_3 Al	14.8	Ni_3 Al	37.6
Fe Al	12.2	Ni Al	34.0
Fe Al_2	19.5	Ni Al_2	37.8
Fe Al_3	26.8(25)	Ni Al_3	38.0
Cu_2 Al	16.0	Zn Sb	3.6
Cu Al	9.5		
Cu Al_2	9.5		

The curves obtained were also used for determining the heats of mixture of the melts. The heats of mixture of the Co-Si melts at 1600° C. are, for average concentrations (45-58 at % Si) somewhat lower, at other concentrations somewhat higher than the heats of formation; those of the Cu-Al melts at 1150° C. about 20% lower than the heats of formation. Heats of mixture of Zu-Sb melts are about 1/3 of the heats of formation. 47 references. Ha (11)

The Influence of Mechanical Vibrations on the Tensile Properties of Structural Materials (Einfluss von mechanischen Schwingungen auf die Festigkeitseigenschaften von Konstruktionswerkstoffen) G. WELTER (Tech. Hochschule, Warschau) *Z. Metallkunde,* Vol. 29, Feb. 1937, pp. 60-2. *Rev. Tech. Luxembourg,* Vol. 29, Mar./Apr. 1937, pp. 34-39. Original research. Stress-strain curves for 0.08% C steel, brass, Al, duralumin, and Mg alloy of elektron type were made on wires and tensile specimens, (a) under normal conditions, and (b) during high frequency vibration produced by drawing a rosined hair-bow across the specimen. A general lowering of the tensile properties was observed, 3.7 to 8.6%, for tensile strength, and 7.5 to 47% for elongation for example; the effect of the vibrations is greater the higher the relative load and the less favorable the critical vibration is for the material. The tensile specimen of duralumin showed an increase in these properties when subjected to vibration. More thorough research in this relatively unknown field is advocated. GD + Ha (11)

The Role of Capillarity in the Foundry (Le Role de la Capillarité en Fonderie) A. PORTEVIN & P. BASTIEN. *Bull. Assoc. Tech. Fonderie,* Vol. 10, Oct. 1936, pp. 367-377. French exchange paper presented at meeting of the Inst. Brit. Foundrymen, Glasgow, June 1936. Surface tension of various metals has been determined by use of capillary tubes, disks, falling drops, and bubbles. The surface tension of Al with and without an oxide skin was determined. 29 references. WHS (11)

Normal Cathode Drop on Single Crystal Surfaces with Different Orientations, I. (Der Normale Kathodenfall an Einkristallflächen verschiedener Orientierung, I) HERBERT KURZKE. *Z. Physik,* Vol. 104, Mar. 15, 1937, pp. 735-743. Original research. The inference that, in a gas discharge, a single crystal used as a cathode exhibits different cathode potential drops according to the surface used was tested. The orientation of a single crystal was found to influence the normal drop in potential to such an extent that there is a difference of 3-4 v. between a (111) and a $(11\text{-}\mathring{1})$ plane of a single Bi crystal. FHC (11)

Polymorphic Transformations of Iron in Iron-zinc Alloys. V. N. SVECHNIKOV & V. GRIDNEV. *Metallurg,* Vol. 12, Jan. 1937, pp. 35-39. In Russian. Powdered electrolytic Fe and Zn containing 1% (Sn + Sb) were placed in cylinders made of commercially pure Fe, properly closed and heated for a sufficient time to effect reaction after which alloys so produced were either quenched or annealed. Zn content varied from 4 to 25% by weight. Microscopic examination and dilatation analysis showed that the alloys are of the closed γ loop type (as in the Fe-Cr system) in which Zn above 15-17% eliminates γ phase. Modified constitutional diagram is proposed for Fe-Zn system. (11)

Transformations in Solid Metallic Phases. VI, Allotropic Transformations (Ueber Umwandlungen von festen Metallphasen, VI, Allotrope Umwandlungen) U. DEHLINGER (Kaiser Wilh.-Inst. Metallforsch.) *Z. Physik,* Vol. 105, Apr. 6, 1937, pp. 21-25. Theoretical discussion. Links thermodynamic equilibrium and the velocity of transformation to the movement of atoms and the energy absorbed by the stopping of these atoms. FHC (11)

Theory of Metallic Binding IV (Zur Theorie der Metallischen Bindung IV) PAUL GOMBÁS. *Z. Physik,* Vol. 104, Mar. 3, 1937, pp. 592-603. Theoretical discussion. Authors develop a statistical method for studying the metallic state of the alkali metals Ca, Sr and Ba which checks with experimental data on compressibility, lattice energies, etc. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 372L/2. FHC (11)

Individual Determination of the Principal Elastic Stresses with X-rays (Einzelbestimmung der elastischen Hauptspannungen mit Röntgenstrahlen) R. GLOCKER & E. OSSWALD. *Z. tech. Physik,* Vol. 16, Aug. 1935, pp. 237-242. See *Metals and Alloys,* Vol. 7, June 1936, p. MA 306R/7. ORS (11)

The Escape of Electricity from Metals: Its Practical Consequences. C. C. PATERSON. *J. Inst. Metals,* Vol. 58, 1936, pp. 313-317. *Engineer,* Vol. 161, May 8, 1936, p. 492. 26th May Lecture. General discussion of the usefulness of electron emission and photoelectric devices. VSP (11)

11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

On Hardening of Aluminum-silicon Alloys (Zur Frage der Aushärtung von Aluminium-Siliziumlegierungen) W. HELLING (Vereinigten Aluminium-Werke A.-G.) *Z. Metallkunde,* Vol. 29, Jan. 1937, pp. 25-28. Original research. By varying the Si content only, it was found that the maximum amount of hardening by precipitation was obtained with 1.5% Si, the solid solubility at the eutectic. The amount of hardening and the amount of Si giving maximum hardening were inversely proportional to the Fe content. The maximum tensile strength obtainable from a combination of cold work and heat treatment was obtained by working quenched but unannealed samples. The change of physical and chemical properties during aging at 218° C. showed an initial continual decrease of the elongation at fracture, while the tensile strength, electrical conductivity, and amount of graphitic Si remained unchanged. The dependence of corrosion resistance upon the amount of graphitic Si varied widely with the type and concentration of the corroding agent. GD (11a)

Digester Blades of Aluminum Bronze (Höllandermesser aus Aluminiumbronze) F. OSTERMANN. *Z. Metallkunde,* Vol. 29, Feb. 1937, p. 67. Original research. Knives for paper-pulp digesters were made of an Al bronze with about 9% Al and compared with the usual phosphor bronze material. The Al bronze showed a higher corrosion resistance in hot and cold 5% sulfuric acid and also better strength and hardness properties. GD (11a)

Effect of Temperature on Young's Modulus of Elasticity. KIYOSI NAKAMURA. *Science Rept. Tohoku Imp. Univ.,* Vol. 25, Nov. 1936, pp. 415-425. In English. Original research. The temperature variation of Young's modulus of elasticity was measured from room temperature to above the Curie point for a series of 8 Ni-Cu alloys varying from 0 to 35.7% Cu. Above 13% Cu the modulus increases from room temperature to the Curie point; with less Cu the modulus decreases, but in all cases there is an abrupt change with steady decrease in the modulus as the temperature increases above the Curie point. BWG (11a)

Dental Amalgams. MARIE L. V. GAYLER (Nat. Physical Lab.) *J. Inst. Metals,* Vol. 60, 1937, Advance Copy No. 767, 12 pp. Original research. Dimensional changes occuring during setting of amalgams were correlated with compositions of dental alloys from which they were made. Results are represented graphically by ternary model for Ag-Sn alloys containing 0-5% Cu. Expansion during setting can be correlated with the presence of β Ag-Sn compound with Ag_3Sn in the dental alloy, while contraction occurs with the presence of free Sn with Ag_3Sn. The first 2 phases exist in alloys containing less than 25% Sn, and the latter in those with more than 27% Sn. Dimensional changes during setting may also be correlated with the composition of the dental filling itself and consequently with the constitution of the Ag-Sn-Hg alloys. Expansion and contraction may be attributed to the disappearance and appearance of the γ_2 (Sn-Hg) phase in the amalgam, (or to the appearance and disappearance of the γ_1 (Ag-Hg) phase. The changes occurring in amalgams are due to complex reactions that probably do not proceed to completion. In dental alloys these reactions, if they go to completion, are probably:

$$(1)\quad Ag_3Sn + Hg \rightarrow \beta_1 + \gamma_2$$
$$(2)\quad \beta_1 + \gamma_2 \rightarrow \beta_1 + \gamma_1 + \gamma_2$$

No explanation for the marked contraction or expansion on setting could be obtained from X-ray data. It is concluded that Gray's theory that expansion may be attributed to crystal growth is probably the true explanation, but that the cause of contraction should be attributed to the absorption of Hg by the dental alloy fillings resulting in formation of a solid solution of Hg in Ag_3Sn and not to the solution of dental alloy in Hg as proposed by Gray. 34 references. JLG (11a)

Influence of Temperature and Cold Working on Mechanical Properties of a Coin Bronze (L'Influence de la Temperature et de l'Écrouissage sur Les Propriétés Mécaniques d'un Bronze pour Medailles) W. BRONIEWSKI & J. SZRENIAWSKI. *Rev. Mét.,* Vol. 33, July 1936, pp. 442-447. Original research. A bronze containing 5% Sn and 95% Cu was investigated from the temperature of liquid air to 700° C. both in the cold worked and annealed state. Low temperatures increase hardness. The maximum hardness is reached at the temperature of liquid air, but its reduction is not a direct function of the temperature. In annealed specimens softening with heating slows down between room temperature and 200° C. while in cold drawn specimens a sharp break in softening curve occurs at 500° C. Influence of cold deformation can be subdivided in 3 ranges. Its increase up to 20% practically eliminates elongation of specimens. When cold deformation passes 72% a marked drop of reduction of area is observed. Tempering specimens at 200° C., after stressing up to 20% results in the maximum hardness. Hardness decrease begins at temperatures that are lower the greater the amount of cold deformation, and is attended by formation of ultra microscopic crystals which coagulate at higher temperatures. The ratio between hardness as measured usually and true hardness (independent of cold working produced by the pressure of the ball) for this bronze is 3.1. JDG (11a)

Paramagnetic Susceptibility of Colloidal Powder of Platinum. NOBORU TAKATORI. *Science Repts. Tohoku Imp. Univ.,* Vol. 25, Nov. 1936, pp. 489-503. In English. Original research. The specific magnetic susceptibility of colloidal particles of Pt was found to be 0.770 to 0.817 × 10^{-6} or 21% less than annealed Pt powder. This susceptibility decreases with decreasing particle size. Colloidal Pt was found to be from 1.8 to 3.0 × 10^{-5} mm. in size. BWG (11a)

The Magnetic Susceptibility of Metallic Cerium and Praseodymium (Ueber die magnetische Suszeptibilität des metallischen Cer und Praseodym) L. F. WERETSCHTSCHAGIN, L. W. SCHUBNIKOW & B. G. LASAREW. *Physik Z. Sowjetunion,* Vol. 10, No. 5, 1936, pp. 618-624. In German. Original research. The magnetic susceptibilities were determined in the temperature range from 20° C. to the temperature of liquid H. Results on Ce (containing less than .01% Fe) do not confirm previous findings of Drijjina & Janus and Trombe in that metallic Ce does not follow the Curie-Weiss law. Pr was found to follow it. EF (11a)

Relation of Temperature to Indentation Hardness of Metals—III (Die Temperaturabhängigkeit der Kegeldruckhärte der Metalle—III). J. ENGL & J. KATZ (Phys. Inst. Tech. Hochschule, Berlin-Charlottenburg). *Z. Physik,* Vol. 106, June 8, 1937, pp. 1-8. Original research. Curves are drawn to show the variation in hardness of Cu, Ni, Mo and W from 0° C. to —190° C. for Part II. See *Metals and Alloys,* Vol. 7, June 1936, p. MA 316L/3. FHC (11a)

The Nickel Industry in 1936. ROBERT C. STANLEY. *Metal Ind., London,* Vol. 50, Jan. 8, 1937, pp. 27-33. Review. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 382L/4. RWB (11a)

Electrical Anisotropy of Tungsten Single Crystals at Low Temperatures in Strong Transverse Magnetic Fields (Die elektrische Anisotropie von Wolfram Einkristallen bei tiefen Temperaturen in starken magnetischen Transversalfeldern) E. JUSTI & H. SCHEFFERS. (Phys. Tech. Reichsanstalt) *Physik. Z.,* Vol. 37, Oct. 15, 1936, pp. 700-708. Original research. The electrical resistance of single crystals of pure W drops to 1/1000 of that at 0° C when exposed to liquid He temperatures. Application of a transverse magnetic field of 20,000 Gauss restores the electrical resistance to that at 0° C. Even below liquid N temperature electrical resistance is no longer isotropic. This phenomenon was quantitatively investigated and the deviations from previous results obtained on face-centered Au are interpreted. Contaminations in W were found to affect very materially the resistance changes. EF (11a)

Creep Processes and the Endurance Limit of Lead and Lead Alloys (Kriechvorgang und Dauerstandfestigkeit untersucht an Blei und Bleilegierungen) K. v. HANFFSTENGEL & H. HANEMANN (Tech. Hochschule, Berlin) *Z. Metallkunde*, Vol. 29, Feb. 1937, pp. 50-52. Literature review and original research. The creep process in Pb is discussed in relation to ideas already developed for other metals. A creep-temperature curve is given which may be resolved into three different deformation processes: elongation as a result of atomic mobility (1) at grain boundaries and (2) within the grain by recrystallization and recovery, and (3) by elongation due to translation. GD (11a)

The Influence of Arsenic and Copper on the Hardening of Lead-antimony Alloys (Der Einfluss von Arsen und Kupfer auf die Aushärtung von Blei-Antimon-Legierungen) M. BLUTH & H. HANEMANN (Tech. Hochschule, Berlin) *Z. Metallkunde,* Vol. 29, Feb. 1937, pp. 48-50. Experimental research. Small amounts of As and Cu increased the hardness and rate of hardening of Pb alloys containing up to 2% Sb, the maximum effect occurring with 0.005% Cu and 0.05% As. GD (11a)

Magnesium Alloys. C. H. DESCH (Nat. Physical Lab.) *J. Roy. Aeronaut. Soc.,* Vol. 41, May 1937, pp. 369-381; discussion, pp. 381-387. Comprehensive survey, covering developments during the last 3 yrs. in the production of light metal alloys for aircraft construction, the heat treatment of castings, age-hardening of forged alloys, forging conditions at various temperatures and the relation between all of these and the crystal structure of Mg. FPP (11a)

Ultra Light Magnesium Base Alloys. Some Peculiarities of their Working and Technique of Use (Les Alliages Ultra-legers à Base de Magnésium. Quelques Particularités de leur Travail et de leur Technique) M. BARDOT. *Tech. Moderne,* Vol. 28, Oct. 1, 1936, pp. 687-688. Review. FR (11a)

Aluminum Bronze. J. E. CROWN (U. S. Naval Gun Factory) *Iron Age,* Vol. 139, May 14, 1937, pp. 74C-74D. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 341R/10. VSP (11a)

The Resistance of Some Special Bronzes to Fatigue and Corrosion-fatigue. H. J. GOUGH & D. G. SOPWITH. *Engineer,* Vol. 163, Mar. 19, 1937, p. 330. *Engineering,* Vol. 143, Mar. 26, 1937, p. 338. Includes discussion. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 165L/2. LFM (11a)

On the Activation of Rh, Ag, and Cu with Neutrons (Zur Aktivierung von Rh, Ag und Cu mit Neutronen) H. K. MÜLLER. *Naturwissenschaften,* Vol. 25, Apr. 16, 1937, pp. 251-252. Experimental. Some details and half-life values are given for Rh, Ag and Cu. These three metals are fairly easily activated with neutrons. JZB (11a)

Stress-strain Characteristics of Copper, Silver and Gold. J. MCKEOWN & O. F. HUDSON. *Engineer,* Vol. 163, Mar. 26, 1937, p. 356. *Engineering,* Vol. 143, Mar. 26, 1937, p. 338. Includes discussion. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 170L/2. LFM (11a)

Electrolytic Production of Alloys of Zinc and Barium and their Constitutional Diagram. I. I. KORNILOV. *Tsvetnye Metall.,* No. 10, Dec. 1935, pp. 73-84. In Russian. Alloys of Zn and Ba were made by electrolysis of molten BaCl with molten Zn serving as cathode. Ba, separated electrolytically, alloys with molten Zn. The maximum Ba content obtained was 11%; alloys with higher Ba could not be obtained because of evaporation of Zn. Microscopic and chemical examination, thermal analysis and hardness tests of cast and heat treated alloys indicated absence of solid solutions. The alloys were found to consist of a matrix of pure Zn and a second phase roughly corresponding to formula $Zn_{12}Ba$. The melting point of the alloys increases from that of pure Zn to about 900° C. at 10.6% Ba. The freezing point of alloys is that of pure Zn. The micro-structure is typical of antifriction alloys. 7 references. BND (11a)

The Influence of Impurities on the Properties of Lead. Part IV.—Some Effects of Antimony on the Rate of Recrystallization of Distorted Lead. R. S. RUSSELL. *Proc. Australasian Inst. Mining & Met.*, No. 101, Mar. 31, 1936, pp. 23-30. Original research. Electrolytic Pb (0.0005% total impurities) after distortion in a standard manner at room temperature recrystallized in 5 min. Under the same conditions, an alloy containing 0.05% Sb (alloyed and cast in vacuo) took 14 days to recrystallize; times were irregular and in 1 specimen different areas recrystallized independently of each other, due to segregation of Sb by coring. To remove coring, the alloy was cold worked and annealed, whereupon the recrystallization times were less and the change proceeded more regularly, until eventually alloy specimens were obtained which would recrystallize in 2 hrs. The preliminary treatment necessary to obtain this effect was 66% reduction in thickness by cold rolling followed by annealing at 300° for 10 days in vacuo. Hence the effect of Sb depends largely on the way in which it is distributed. The grain size of the Pb was not appreciably altered at any stage of the tests by the presence of 0.05% Sb, indicating the unreliability of grain size as a criterion of Pb purity. **Part V.—Creep Tests on Electrolytic Lead and Some of Its Alloys.** R. S. RUSSELL. *Ibid.*, pp. 33-56. The life of electrolytic Pb at 500 lbs./in.^{2} stress is 25 days with an elongation of 34% Any of the alloying elements tried (0.0001, 0.0005 and 0.005% Ag; 0.005% Bi; 0.05% Sb; 0.04% Te; and 0.05% Zn alloyed and cast at 500° in vacuo and kept from contact with air by vaseline) delay creep appreciably, and in some cases considerably at that stress. At 350 lbs./in.^{2} the effect of alloying is relatively less marked. The curve for Ag (0.0001 and 0.0005%) shows a bend due to recrystallization; 0.005% Ag gives a curve of a different type. Bi has a comparatively small effect at 500 lbs., but at 350 and 200 lbs./in.^{2} its effect is greatest of all. The Sb alloy, if coring is removed, shows no recrystallization, but the cored alloy shows a slow recrystallization. The Te alloy shows a gradually increasing creep rate and severe cracking was observed at about 12% elongation. The Zn alloy creeps most slowly of all at 500 lb. stress. Tests on electrolytic Pb, vacuum cast and exposed to atmosphere, are said to show that atmospheric gases diffuse into Pb at ordinary temperatures. Electrolytic Pb air-cast at 500° had a higher creep rate than that cast at 600°. **Part VI.—The Influence of Tellurium on the Creep Rate of Commercial Lead.** J. NEILL GREENWOOD & HOWARD K. WORNER. *Ibid.*, pp. 57-87. Even 0.01% Te has a marked stiffening effect during cold working. Rolled material is unstable, softening with time. Rate of creep of alloys in the "as-rolled" condition, tests started 1 week after rolling, continuously increased as the test proceeded. During the first 30 days only, the softest alloys stretch fastest; after that the Te alloys, harder than the unalloyed Pb, creep at a greater rate, and the greater the Te content, the greater the rate of creep. The extension of the alloys is very regular along the test length. Extension indicates increased ductility from Te, reduction of area at the fracture indicates the reverse. TePb alloys in the "as rolled" condition behave under the given conditions as though the time rate of softening, due to loss of hardness acquired in rolling, is greater than the time rate of hardening due to the strain which occurs during the test. Tests started 10 weeks after rolling show that the alloys have to some extent softened by spontaneous annealing in the 9 weeks between the 2 series. Creep is greater in a given time the higher the Te content. Each alloy showed greater stretch than the corresponding test, 1 week after rolling; this difference is greater, the greater the Te content. The type of creep curve in all 3 cases is similar to that obtained after standing 1 week. Tests started 26 weeks after rolling showed a further increase in rate of creep for all except the 1 with the least (0.01%) Te. Te seems to retard the rate at which spontaneous annealing takes place. Tests after annealing 3 hrs. at 120° (to speed up action) and standing for 3 hrs. to 3 weeks are inconclusive, but the alloy containing 0.05% Te indicates a distinct possibility of age hardening occurring in these alloys. Extremely fine grain results from annealing after distortion. See *Metals and Alloys*, Vol. 6, Aug. 1935, p. MA 334L/1.
AHE (11a)

Light Aluminium Alloys; Composition and Properties. P. M. HAENNI. *Times Trade and Eng.*, Vol. 40, Mar. 1937, pp. 6, 8. Discusses effects of the common alloying elements, and alloys produced commercially. A useful table lists the trade-names or designations of similar or derived alloys and the countries in which such alloys are produced.
MS (11a)

Tensile Strength and Elastic Limit of Sheets of Refined Aluminum (Zerreissfestigkeit und Dehngrenze von Blech aus raffiniertem Aluminium) H. RÖHRIG & K. SCHÖNHERR. *Aluminium*, Vol. 19, Jan. 1937, p. 6. Original research. 99.992% pure Al (0.006% Fe, 0.002% Si) showed 17,000 lbs./in.^{2} tensile strength with 88-85% reduction of area as rolled, while in annealed state these figures were 5800 to 6800 lbs./in.^{2} and about 98% reduction of area. The ratio of the tensile strength as rolled and as annealed is affected by purity. See also *Metals and Alloys*, Vol. 8, Jan. 1937, p. MA 37L/6.
Ha (11a)

"CHACE Thermostatic BIMETAL used in the Janitrol UNIT HEATERS"
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11b. Ferrous

V. V. KENDALL, SECTION EDITOR

The Effect of Longitudinal Scratches upon the Endurance Limit in Torsion of Spring Wire. F. P. ZIMMERLI (Barnes-Gibson-Raymond, Inc. *Wire & Wire Prod.*, Vol. 12, Mar. 1937, pp. 133-138, 154; Apr. 1937, pp. 185-191. The article covers a Report by the Research Dept. of the Associated Spring Manufacturers the results of which are given in photomicrographs and can be summarized as follows: Scratches may be measured accurately by plating the wire heavily with Cu, polishing across section and examining the scratch with a microscope. Scratches on polished torsional fatigue test specimens lower the endurance limit directly with the depth of the scratch and inversely with the radius of the curvature at the bottom of the scratch. The effect of the nature of the scratch was also determined. 6 references. Ha (11b)

Refractory Cast Irons (État Actuel de la Technique des Fontes Réfractaires en France) A. LE THOMAS. *Bull. Assoc. Tech Fonderie*, Vol. 10, Oct. 1936, pp. 379-391. French exchange paper presented at Intern. Foundry Cong., Dusseldorf, Sept. 1936. Comprehensive report on the subject of heat resistant cast Fe as produced in France at the present time. The theory of the action of heat on cast Fe and various types of resistant cast Fe are discussed. 21 references.
WHS (11b)

Macrostructure of Cast Iron. K. F. STARODUBOV & F. M. GORBACHEVA. *Metallurg*, Vol. 11, Dec. 1936, pp. 89-94. In Russian. A 50 x 50 x 1700 mm. ingot was investigated in order to find the relation between coupons and the general structure of the ingot. Microscopic examination and Baumann S prints were used. Coupons cannot be used as samples because their structure is entirely different from the body of the metal. The structure of the ingot was not uniform.
(11b)

Magnetostriction of Fe Crystals at Elevated Temperature (Über die Magnetostriktion der Eisenkristalle bei hoher Temperatur) H. TAKAKI (Univ. Hokkaido) *Z. Physik*, Vol. 105, Apr. 6, 1937, pp. 92-103. Original research. The magnetostriction for single Fe crystals was determined for temperatures up to the Curie point.
FHC (11b)

Scaling of Iron (Beitrag zum Verzunderungsmechanismus des Eisens) W. Baukloh & V. Sittard (Tech. Hochschule, Berlin) *Metallwirtschaft,* Vol. 16, Apr. 2, 1937, pp. 323-325. Original research. With increasing air velocity the scaling of Armco Fe and of a .75% C steel was noted to increase to a maximum and then to drop and finally reach a constant state at high air speeds. The maxima occurred at practically the same air velocity for both Armco and the C steel. Apparently the oxidation of the carbon to CO and CO_2 simultaneously with the formation of scale has no influence upon the physical nature of the scale. The mechanism of scaling at various air velocities is represented as being the resultant of two processes: an increase in scaling caused by increased reaction velocity due to greater availability of oxygen and secondly a decrease in scaling brought about by increased reaction hindrance caused by increasing scale thickness. Chemical analysis of blisters in the scale showed them to be Fe_2O_3. Analysis at the interface between adhering scale and metal showed the presence of Wustite. The authors theorize that under unbroken blisters there is N-enrichment which hinders the oxidation process. At low air velocities the scale is porous and weak while at high air velocities the scale is thicker, mechanically stronger and more adherent. GA (11b)

Speed of Linear Growth and of Nuclei Formation in the Secondary Crystallization of Special Steels. I. L. Mirkin & M. E. Blanter. *Metallurg,* Vol. 11, Dec. 1936, pp. 43-50. In Russian. Original research. Disks of 1.0% C, 1.16% Cr steel, 20 mm. diam. and 2 mm. thick were quenched and drawn in the range 250-700° C. at 50° C. intervals. Grain size was determined and plotted on the frequency curve. Determinations were made in the range of austenite decomposition not greater than 25%. The values obtained introduced in formulas, the derivation of which is given, showed that the speed of linear growth increases to a maximum at 650° C. where it equals 9.6×10^{-4} mm./sec. and then decreases becoming 1.76×10^{-4} mm./sec. at 550° C. The speed of nuclei formation increases from 2.35×10^5/mm.^{3}/sec. at 700° C. to a maximum of 7.75×10^5/mm.^{3}/sec. at 600° C. and then drops to 2.69×10^5/mm.^{3}/sec. at 550° C. Comparing these results with the S-curve data obtained on the same materials indicated coincidence of the fastest decomposition range with the range of the highest parameters of recrystallization. (11b)

Iron-chromium, Iron-chromium-nickel and Related Alloys. Report of A.S.T.M. Committee A-10. Jerome Strauss, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 4 pp. General progress report. VVK (11b)

The Estimation, Effect, and Control of Grain Size in Steel. E. Houdremont & H. Schrader. *Metal Treatment,* Vol. 3, Spring 1937, pp. 18-26. Extended abstract. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 434R/5. JCC (11b)

Steel, Report of A.S.T.M. Committee A-1. H. H. Morgan, Chairman. *Am. Soc. Testing Materials,* Preprint for June 1937 meeting, 60 pp. Progress report. New proposed tentative specifications issued for 1937 are for Seamless Intermediate Alloy-steel Still Tubes for Refinery Service, Seamless Cold-drawn Intermediate Alloy-steel Heat-exchanger and Condenser Tubes, C-Si Steel Plates of Ordinary Tensile Ranges for Fusion-welded Boilers and Other Pressure Vessels, Cr-Mn-Si, (CMS) Alloy-steel Plates for Boilers and Other Pressure Vessels, Low C-Ni Steel Plates for Boilers and Other Pressure Vessels, Molybdenum-steel Plates for Boilers and Other Pressure Vessels, and Fe and Steel Filler Metal (Arc-welding Electrodes and Gas-welding Rods). VVK (11b)

Modern Improved Cast Irons. J. W. Donaldson. *Metal Treatment,* Vol. 3, Spring 1937, pp. 8-12, 15. Review. Deals with high duty, alloy, heat and corrosion resisting cast irons and their heat-treatment. 13 references. JCC (11b)

Grain Size and Hardness Penetration of Carbon Tool Steel. A. Markariants. *Metallurg,* Vol. 12, Jan. 1937, pp. 91-96. In Russian. Determines hardness penetration and coarsening temperature of two steels. (11b)

The Hardenability of Cast Iron. D. W. Murphy & W. P. Wood (Univ. Michigan) *Am. Foundrymen's Assoc.,* Preprint 37-18, 1937, 24 pp. Data are presented from 5 heats to illustrate the use of Al additions to molten Fe to confer shallow-hardening properties to the Fe. Al additions of the order of 0.02 to 0.03% produced shallow hardening characteristics in the base irons studied. The melting practice prior to deoxidizing with Al is of great importance. Shallow hardening irons tend in the as-cast state to show a slightly higher deflection rate in the transverse test, a lower tensile strength, and a comparatively higher impact strength than do the deep hardening irons. CMS (11b)

Austenite Transformation in Chromium-silicon Steel (Etude sur les Transformations de l'Austenite dans un Acier au Chrome-silicium) S. Steinberg, V. Susin & I. Golden. *Rev. Mèt.,* Vol. 34, Feb. 1937, pp. 190-194. Original research. See *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 100R/4. JDG (11b)

The Influence of Vanadium on Nickel-chromium and Nickel-chromium-molybdenum Steels. H. H. Abram. *Engineering,* Vol. 143, Jan. 8, 1937, p. 53. See *Metals and Alloys,* Vol. 8, May 1937, p. MA 301L/1. LFM (11b)

Steel Manufactured in France (Les Aciers de Fabrication Francaise) *Mécanique,* Vol. 20, July-Aug. 1936. Deals with tool steels and is divided as follows: (1) general properties, (2) physical properties, (3) mechanical properties at high temperatures, (4) corrosion resistance, (5) composition, (6) heat treatment, (7) machinability, (8) trade names. FR (11b)

Present Trend in Engineering Alloys. J. A. Jones (United Steel Co., Ltd., England) *Iron Age,* Vol. 139, May 20, 1937, pp. 32-37. See *Metals and Alloys,* Vol. 8, June 1937, p. MA 375R/8. VSP (11b)

Quality Iron Castings in Modern Mechanical Designs. P. E. McKinney (Bethlehem Steel Co.) *Products Eng.,* Vol. 8, May 1937, pp. 177-180. A general discussion of alloyed cast Fe's, their properties and compositions, and examples of uses in large and complicated castings. Ha (11b)

High Speed Steels. E. Pasley (Samuel Osborn & Co.) *Wild-Barfield Heat-Treatment J., Vol.* 2, Mar. 1937, pp. 51-54. Review. Discusses general analyses available, effect of individual constituents, methods of melting, working and heat treatment, microstructures and mechanical properties of tool steels of the high speed type. FPP (11b)

Density Measurement of Molten Alloys of Iron. Kenyo Honda (Kumamoto Tech. College) *Tetsu-to-Hagane,* Vol. 23, Apr. 25, 1937, pp. 344-347. In Japanese. Original research. Density measurement of molten alloys, two each of the systems Fe-C, Fe-S-C, and Fe-Mn-C, was made in the temperature range 1321°-1412° C. The method of measurement of density is an indirect one, that is, density is calculated by measuring the buoyancy of molten alloy caused by the displacement of a refractory substance, which was dipped into the molten alloy and the weight of which was previously measured. NS (11b)

New Method Imparts Stiffness to Cold Rolled Tin Plate. *Steel,* Vol. 100, June 28, 1937, pp. 56-57. By precision control of heat treatment and cold rolling, it is possible to produce tin-plate having equal strength along and across the grain and to impart stiffness without reducing its workability. Tests with resulting plate show that its yield-point is higher than that of conventional product of hot tin mills but its fatigue bend value is unusually high. Process was developed by Cold Metal Process Co. MS (11b)

Cast Iron vs. Other Structural Materials (Défense de la Fonte contre les autres Matériaux de Constructions) A. Le Thomas. *Usine,* Vol. 46, Mar. 11, 1937, pp. 27-31. General discussion of structural materials. The advantages of cast Fe because of its easy casting, damping of vibrations, easy modification of its properties, wear resistance and corrosion resistance are dealt with. Ha (11b)

Nickel-bearing Alloys for Refinery Service. B. B. Morton (Intern. Nickel Co.) *Refiner Natural Gasoline Mfr.,* Vol. 16, Mar. 1937, pp. 101-104. Data are given on the resistance of bronze, Causul Metal, Monel metal and Pb in sulphuric acid and the effect of temperature up to 220° F. on Monel in sulphuric acid. Physical and impact values at low temperatures are given for Monel Metal, 2.5-3.5% Ni cast steels and 2.15-0.33 Ni-Mo cast steel. Applications to oil refinery equipment are pointed out. See *Metals and Alloys,* Vol. 7, July 1936, p. MA 378L/3. VVK (11b)

Importance of Compression Yield Strength in Establishing Setting Depths for Casing. T. McLean Jasper. *Am. Petroleum Inst.,* Preprint, Nov. 1936, 12 pp. Higher compression yield strength in the transverse direction means increased collapse resistance and setting depth of casing. Higher tension yield strength in the longitudinal direction, coupled with this higher compression yield strength, means increased "pull-out" strength of threaded and coupled casing. This paper outlines the importance of these higher yield strengths, and describes methods for obtaining them. A table of setting-depth values, based on some 500 collapse and correlated tests is provided and the author suggests the revision of A.P.I. setting depths for casing as published in Supplement No. 1 (Jan. 1934) to A.P.I. Code No. 5. VVK (11b)

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor

H. C. CROSS, SECTION EDITOR

Thermal Expansion of Lead-antimony Alloys. Peter Hidnert. *J. Research Natl. Bur. Standards,* Vol. 17, Nov. 1936, pp. 697-708. Original research—very complete. The results of an investigation of the linear thermal expansion of cast Pb-Sb alloys containing from 2.9 to 98.0% of Sb are given. Observations were made at various temperatures between —12 and +200° C. A majority of the curves obtained on cooling lie below the expansion curves obtained on heating. The deviations between these curves are particularly noticeable for the alloys containing up to 15% Sb which were cast in a preheated steel mold and cooled slowly. The deviations are less noticeable for the alloys of higher Sb content which were cast either in a sand mold or a chill mold. It is probable that the deviations indicate a lack of equilibrium in the samples on account of the effect of the casting conditions or of the chemical composition. Equations give linear relations between the coefficients of expansion and the atomic percentage of Sb of the Pb-Sb alloys containing from 4.8 to 97.0 atomic % Sb (2.9 to 95.0% by weight), and show that the coefficiients of expansion decrease linearly with increase in the atomic % of Sb. The densities of the Pb-Sb alloys also decrease linearly with increase in the atomic percentage of Sb. These linear relations are typical of relations for other properties of binary alloys having structures composed of solid solution + eutectic. The coefficients of expansion of the Pb-Sb alloys cover a wide range of values. It is possible to select Pb-Sb alloys that have approximately the same coefficients of expansion as Fe, Ni, Au, Cu, Ag, Al, Mn, and many of their alloys. WAT (12)

Toughness of Nickel-containing Materials at Low Temperatures (Die Zähigkeit nickelhaltiger Werkstoffe bei tiefen Temperaturen) R. Hanel. *Z. Ver. deut. Ing.,* Vol. 81, Apr. 3, 1937, pp. 410-414. Review. (Modern engineering applications frequently require materials that maintain their toughness at low temperatures. Ni and its solid solution alloys possess toughness even at temperatures of liquid air (—192° C.). Steels, in particular C steels, are brittle at low temperatures, and lose their toughness at temperatures between +100° and —180° C. according to their composition. Rust-proof high-Cr steels are brittle even at room temperature while Ni steel with 5% Ni is still tough at —190° C. The other steels lie in between. Low-temperature toughness of steel castings and welds is similarly improved by Ni content. 10 references. [Fine-grained Cr-Mn, Cr-Cu, Zr, V, Ni-V, and Ni-Cu steels also exhibit usable impact properties at moderate low temperatures (—80 and —100 C.). Even Al-killed normalized plain carbon steels in small sections are satisfactory for engineering service to —80 C. See *Metals and Alloys,* Vol. 5, Aug. 1934, p. MA 418R/6 and Vol. 8, Aug. 1937, p. MA 509L/4. H. C. C.] Ha (12)

Effect of Molten Salts in Creep Testing (Einfluss der Salzschmelze beim Dauerstandversuch) W. Schneider & K. Linden. *Arch. Eisenhüttenw.,* Vol. 10, Feb. 1937, pp. 353-358. Original research. Wide scatter in creep-test results of carbon and low-alloy steel specimens heated in nitrite and nitrate salt baths to about 500° C. were traced to an embrittlement of the specimens because of N_2 pickup. This could be avoided by plating the specimens with Ni or Cr [if deformations were small and did not cause failure of the plate and exposure of the base metal.—H.C.C.] SE (12)

Chemical Properties and Stability of Metals at High Temperatures. C. H. M. Jenkins. *Iron & Coal Trades Rev.,* Vol. 135, July 2, 1937, p. 4. A general discussion of the changes in behavior of a metal with rising temperatures. The complexity of the phenomena and their relation with grain structure, deforming forces and chemical resistance are discussed. Ha (12)

Creep of Lead and Lead Alloys. Part I, Creep of Virgin Lead. J. McKeown. *Engineer,* Vol. 163, Mar. 26, 1937, p. 356. *Engineering,* Vol. 143, Apr. 2, 1937, p. 366. Includes discussion. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 435R/5. LFM (12)

Structural Changes in Steel When Subjected to Heat. R. W. Moore (Socony-Vacuum Oil Co.). *Oil Gas J.,* Vol. 35, Mar. 25, 1937, pp. 84-85. Original research. A series of photomicrographs shows the structure of .15% C open hearth steel tubes after 5½ yrs. or 45,000 hrs. service in a deFlorez cracking still. The probable temperature of the metal was 1000-1100° F. The study indicated that there is a general tendency for low C steel to reach a state of ultimate equilibrium when exposed to long soaking at the temperatures to which this metal was subjected. The carbides (Fe_3C) break up into C or graphite and Fe. The metal is softer, more ductile and weaker than originally. VVK (12)

Stud-bolt Material for High Temperatures. Douglas Wilson. *Combustion,* Vol. 8, Aug. 1936, p. 35. Comprehensive review. "Durehete" a Cr-Mo steel that is creep resistant and free from strain-age embrittlement, is discussed. Time-elongation curves of creep tests at 900° F. are given for loads to 10 tons./in.^{2} See *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA 230L/10. AHE + ERK (12)

Kinetics of Activated Adsorption of Hydrogen on Plain Nickel (Die Kinetik der aktivierten Adsorption von Wasserstoff auf ebenem Nickel) O. Lepunsky. *Acta Physicochim.,* U.R.S.S., Vol. 6, No. 6, 1936, pp. 807-812. In German. Original research. H-adsorption tests at —145° and —118° C. Experimental results satisfactorily agree with kinetic equation, derived from Langmuir's concept of activated adsorption. EF (12)

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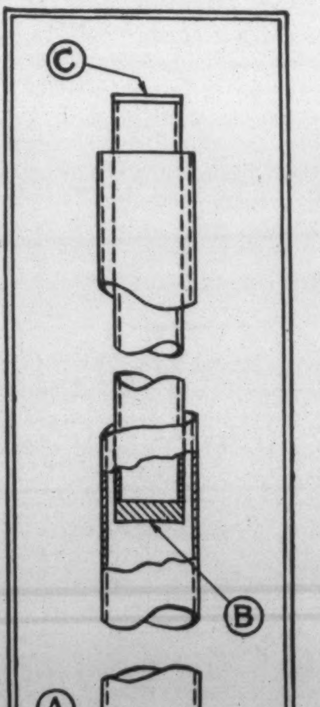

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13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

Minute Nonferritic Particles. A. B. KINZEL (Union Carbide & Carbon Lab.). *J. Applied Phys.*, Vol. 8, May 1937, pp. 341-344. General discussion of effects of nonferritic particles in steel, among which are temper brittleness, strain-age embrittlement and intergranular corrosion. These effects may depend not only on chemical nature and particle size but also on the state of internal strain produced by the particles in the metal matrix. The view is advanced that on lowering the temperature a differential contraction between the particles and the matrix produces hoop tension in the matrix around the particle and thereby effectively prevents deformation. Strain-age precipitation of particles causing intense localized internal strains has a like effect. The effect of particles on corrosion as in 18/8 steels is considered to be due to the decrease of corrosion resistance by this local straining rather than to impoverishment of Cr at the grain boundaries. Experiments are mentioned which tend to show that elastic strain increases the rate of chemical attack. HFK (13)

A Thermodynamic and Colloidal Interpretation of Published Studies on the Corrosion Cracking of Stressed Mild Steel in Water Solutions. J. A. TAJC (Duquesne Light Co.) *Am. Soc. Testing Materials,* Preprint for June 1937 Meeting, 10 pp. Useful theoretical review. Asuming that at elevated temperatures solutions of NaOH and SiO_2 produce predominantly intercrystalline cracking in stressed mild steel, it is shown that the corrosion is not wholly electrochemical but that colloidal phenomena are involved. Thermodynamic calculations are made to show that the spontaneity of the corroding reaction of Fe and H_2O is not affected by the OH ion concentration and that the observed increase in the rate of corrosion with NaOH concentration is probably due to peptization. Reasons for the inadequacy of the H embrittlement theory in explaining caustic embrittlement are given and a colloidal explanation is suggested. It is believed that SiO_2 precipitates the peptized Fe oxide to protect the ferrite grains while permitting corrosion along highly stressed and probably cracked grain boundaries. Concordance between the suggested explanation and experimental data in the literature is given as justification for the colloidal viewpoint. VVK (13)

The Behavior of Metals in the Tanning and Leather Industry (Ueber das Verhalten metallischer Werkstoffe in der Gerbstoff- und Lederindustrie). R. LAUFFMANN (German Exp. Sta. for the Leather Industry). *Korrosion & Metallschutz,* Vol. 13, Mar. 1937, pp. 81-86. Exhaustive review of corrosion effects on metals used in tanning and leather manufacturing industries and of those metal parts that, as finished goods, are in contact with leather. The action of leather on steel, Cu, Zn, Sn, duralumin, bronze and brass increases with increase of relative humidity and temperature, but degreased leathers are more active than subsequently oiled or vaselined leathers. Cu, brass and bronze seem to be more easily attacked by leather while Sn seems to be the most resistant. The tanning process has an important effect on the corrosive attack on the metal. 10 references. Ha (13)

The Acid-resistance of Alloys on an Iron-nickel Basis (Ueber die Säurebeständigkeit von Legierungen auf der Grundlage Eisen-Nickel) M. SCHMIDT & L. WETTERNIK. *Korrosion u. Metallschutz,* Vol. 13, June 1937, pp. 184-189. Original research. Experiments to improve the resistance against HCl and H_2SO_4 of austenitic Cr-Ni steels showed that a satisfactory corrosion resistance exists from 35% Ni upward in Fe-Ni alloys. Still higher Ni percentages are required for HCl in 1:4 concentration. 2% Mo improves this resistance to HCl considerably; additional Mo has no appreciable effect. Mo does not improve resistance to H_2SO_4 except in very high additions, and then only in the presence of considerable Ni. 60% Ni requires at least 10% Mo, 35% Ni, 13% Mo. Cu addition to Fe-Ni reduces the resistance to H_2SO_4 slightly, but improves it noticeably against HCl. Simultaneous addition of Mo and Cu stabilizes the resistance to H_2SO; the ratio of Cu to Mo with high Ni contents seems to be without effect. The acid-cracking which occurs in 25% Ni steels and disappears with higher Ni contents is not affected by Mo alone. A small amount of Cu alone increases the cracking but it disappears again at higher Cu contents. Simultaneous addition of Cu and Mo does not prevent acid-cracking except at higher Mo contents; again the Ni content is important, for the higher the Ni the lower should be the Mo content. Curves illustrate the conditions for all alloys. Ha (13)

Laboratory Corrosion Tests of Welded Low-carbon Stainless Steel. GEORGE A. ELLINGER & LEON C. BIBBER. *J. Research Natl. Bur. Standards,* Vol. 18, Jan. 1937, pp. 69-82. Original research. Welded specimens of low-C (less than .06%) stainless steel were exposed to the corrosive attack of 3 different solutions. Results of these tests were as follows: In a $CuSO_4$—H_2SO_4 solution, intergranular corrosion did not ocur in either plate or weld-metal regardless of the heat treatment. In boiling HNO_3, intergranular corrosion occurred only in certain heat-treated plates of low-C stainless steel. Intergranular corrosion did not occur in welded metal, with or without heat treatment. In HCl acid of high concentration, the corrosion rate of plate metal was not affected by heat treatment, but the corrosion rate of weld metal was considerably decreased by heat treatment at high temperatures. Intergranular corrosion was not observed in any specimen exposed to this reagent. These results can be explained on the basis of selective attack by the corrosive agents on certain constituents of the steel samples. WAT (13)

Corrosion of Heat Resisting Steels by Hot Gases (Förlopp vid angrepp av heta gaser på värmebeständiga stål) ED. HOUDREMONT & G. BANDEL. *Jernkontorets Ann.,* Vol. 121, Feb. 1937, pp. 64-87. General survey of corrosion. Determination of weight losses or gains does not adequately represent the resistance of steel to hot gas attack. It is important to note the superficial appearance of the metal, and possible structural changes. Likewise, selective attack of the various elements should be considered as well as the influence that oxidation or nitridation may have on subsequent attack by another gas. Numerous examples are given of various types of corrosion. HCD (13)

The Oxidation of Pure and Alloyed Copper (Die Zunderung von Reinem und von legiertem Kupfer). K. W. FRÖHLICH (Kaiser-Wilhelm Inst. Metallforsch.) *Z. Metallkunde,* Vol. 28, Dec. 1936, pp. 368-75. Original research. The rate of oxidation of pure Cu is independent of the method of preparation and pretreatment, also of O_2 pressure between 45 and 760 mm. of Hg. Apparently Cu diffuses into the Cu_2O layer, as normal Cu_2O does not occupy all the Cu lattice positions, and analysis shows an excess (by diffusion) of Cu in the oxide formed. In most alloys the region between the base metal and oxide layer is enriched in the alloying element. However, Ca, Cr, Li, Mn, Si, and Ti form a well defined layer of their own oxide. Alloys with Al, Be, and Mg are easily oxidized; while alloys with B, Si, Sn or Zn, whose oxides restrain diffusion, resist oxidation. Metal diffuses into the oxide layer, but O_2 also diffuses into the alloy as is shown by the formation of a Cu-rich zone containing oxide inclusions of Mn, Ni, Si, Zn, Ti, or Sn. Such regions lead to a decrease in tensile strength. GD (13)

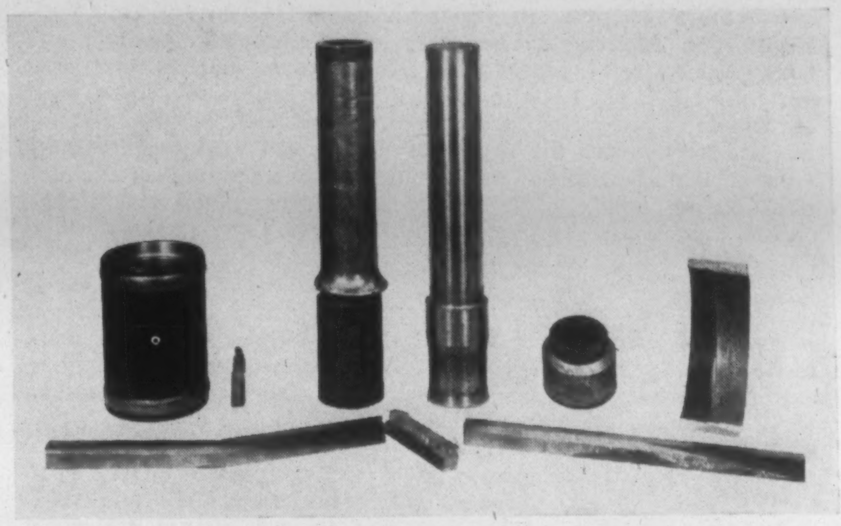
Method for Determining Corrosion Resistance (Praktisk Metod för Bestämning av Korrosionsbeständighet). HARALD SJÖVALL. *Jernkontorets Ann.,* Vol. 120, Nov. 1936, pp. 684-91. The method consists in measuring the potential difference between a negative Pt electrode and an electrode of the test piece. A 3% NaCl solution is used as the electrolyte. Readings are taken after a standard time interval which should not be less than 30 sec. The current is plotted on an arbitrary scale ranging from zero to current at short circuit. The corrosion resistance of any given test piece is then rated by comparing with the currents flowing with various metals such as Au, stainless steel, C steel, Al, etc. HCD (13)

Modern Treatment of Feedwater Particularly for High-pressure Boilers (Die moderne Speisewasserpflege mit besonderer Berücksichtigung der Hochdruckkessel). R. STUMPER. *Korrosion u. Metallschutz,* Vol. 13, Mar. 1937, pp. 73-81. Review. Present tendencies and methods of adapting and purifying water, according to local conditions, by removing all scale- and corrosion-forming constituents are discussed exhaustively. Ha (13)

Progress in the Corrosion Protection of Refrigerating Installations (Fortschritte im Korrosionsschutz von Kühlanlagen) E. BELANI. *Korrosion u. Metallschutz,* Vol. 13, Mar. 1937, pp. 94-95. Harmful effects of various cooling fluids and salts are discussed for the different parts of a refrigeration installation. Phosphatizing has proved recently to be an effective protection. Ha (13)

Theory and Investigation of Corrosion (Theorie und Untersuchung der Korrosion) Fundamentals of the Methods and Technique of Potential Measurements in the Investigation of Corrosion and in Topochemical Research (Grundsätzliches zur Methodik von Potentialmessungen in der Korrosionsforschung und bei topochemischen Untersuchungen) FRIEDR. MÜLLER (Tech. Univ., Dresden) *Korrosion u. Metallschutz,* Vol. 13, Apr. May 1937, pp. 109-114. A general discussion of the mechanism of corrosion and the conditions responsible for it; the theories evolved and the usefulness of methods of measurement. Although no generally satisfactory explanation has so far been found, local element potentials and individual electrode potentials are known to be of prime importance. The original potential difference between two local elements is not so important as the potential difference set up during the corrosion, which depends on polarization, shape and surface of the electrodes, presence of oxidizing agents, solubility and other factors. Special attention must be paid, when measuring the potential difference, to the effect of the measuring instruments themselves on electrical observations. 15 references.—**Theory of Electrochemical Polyelectrode Systems and Their Application to Corrosion Problems. Potentials of the Binary Systems (Theorie der elektrochemischen Polyelektrodensysteme und ihre Anwendung auf die Korrosionsprobleme. Potentiale der binären Systeme)** G. W. AKIMOW & N. D. TOMASCHOW. *Ibid.,* pp. 114-123. Formulas for the dependence of the potential of a binary system on the ratio between the resistances of the anodic and cathodic parts of the system were developed and experimentally checked. An effect of the ratio of the anode surface to the cathode surface was found. 15 references.—**An Electrochemical Study of the Corrosion of Metals (Eine elektrochemische Studie zur Korrosion der Metalle)** J. B. CHLOUPEK & V. Z. DANES (Tech. Univ., Prague) *Ibid.,* pp. 124-128. An electrochemical method of studying corrosion is described by which microscopic observations of a local element can be made and the e. m. f. and certain chemical factors measured. The measurements then permit drawing conclusions as to the corrosion-resistance of the metal to corrosion. A non-polarizable Ag electrode (as cathode) is used. 19 references.—**Coloriscopic Proof of Corrosion by the pH-Indicator (Koloriskopischer Nachweis der Korrosion mittels pH-Indikator)** N. GOLDOWSKI. *Ibid.,* pp. 128-131. Descriptive. See *Metals and Alloys,* Vol. 5, Sept. 1934, p. MA 463. **The Application of Potential Measurements in Studying the Corrosive Behavior of Metals (Ueber die Anwendung von Potentialmessungen zum Studium des korrosiven Verhaltens der Metalle)** L. GUITTON (Ugine) *Ibid.,* pp. 131-144. The electrochemical theory of corrosion of metals is explained and experiments are described to determine the nature of passivity. All metals of technical purity show abnormal passivity. Anodic polarization effects a perfect protection of the surface whereby the original potential is shifted to nobler values. Anodic oxidation gives partial protection only, as the oxidation products are soluble in the electrolyte. Abnormal activity exists if the solubility of the metal exceeds the value which could be expected from the solution potential; this is observed especially in nobler metals, which remain passive without cathodic depolarization. Anodic passivation caused by suppressing e. m. f. is similar to anodic oxidation. Not all metals are able to form local elements with OH electrodes; this local element formation is necessary for passivation as the latter is characterized by formation of a hydroxide intermediary layer between metal and liquid. 10 references. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 439L/5.—**Theory of Corrosion Phenomena V. The Relation between Potential Adjustment, Corrosion and Corrosion Passivity of Metals in Aqueous Solutions (Zur Theorie der Korrosionserscheinungen V. Ueber den Zusammenhang zwischen Potentialeinstellung, Korrosion und Korrosionspassivität von Metallen in wässrigen Lösungen)** W. J. MÜLLER (Tech. Univ., Vienna) *Ibid.,* pp. 144-157. The theories of de la Rive, of Thiel and of Eckell are discussed and the first is found to give at present the simplest explanation of the solution of a metal as a local element. The role of O in this process is threefold: (1) It prevents the solution of the natural oxide film, (2) it depolarizes the local cathodes through which the Fe is dissolved at the local anodes, and (3) it oxidizes purely chemically, at a pH of 5-10, ferrous hydroxide to ferrous-ferric hydroxide and ferric hydroxide (rust). 34 references. See also *Metals and Alloys,* Vol. 7, Dec. 1936, p. MA 609L/4.—**Theory of Corrosion Phenomena Dependent on Oxygen Depolarization (Zur Theorie der durch Sauerstoffdepolarisation bedingten Korrosionsvorgänge)** F. TÖDT. *Ibid.,* pp. 157-162. Polemical. Ha (13)

Corrosion of Aluminum Containers in Breweries (Korrosionen an Aluminiumgefässen in Brauereien) W. VINZ. *Korrosion u. Metallschutz,* Vol. 13, Mar. 1937, pp. 90-91. Practical. Fermentation tanks of Al were badly corroded on the walls but not at the corners. This was ascribed to galvanic action between the Al and cooling coils of Cu suspended in the tank, with the wort acting as the electrolyte for the element Cu-Al. Removal of all Cu from such vessels seems necessary. Ha (13)



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or it may be

CAST INTO SHAPES OF THICK OR THIN SECTIONS

or it may be

USED TO ALLOY CAST IRON, COPPER OR STEEL TO INCREASE ITS CORROSION RESISTANCE AND ITS WEAR RESISTANCE.

ACID CORROSION TESTS

BASE METAL	Percent Colmonoy No. 6	Rockwell Hardness	LOSSES IN PERCENT				
			Sulphuric Acid		Hydrochloric Acid		Nitric Acid
			Cold 100 hrs.	175° F. 100 hrs.	Cold 100 hrs.	175° F. 100 hrs.	Cold 100 hrs.
Colmonoy No. 6		58 C	.05	.82	.14		4.22
Mild Steel	none		57.69	31.72	27.00	20.42	over 10.000
Mild Steel	25	6 C	.53	.51	6.15	5.22	8.60
CAST IRON	none	50 C	33.51	4.33	63.65	16.83	997.00
CAST IRON	5	56 C	65.91	12.60	100.95	21.65	2185.00
CAST IRON	15	29 C	1.07	2.90	18.35	13.16	29.30
CAST IRON	25	28 C	.32	.54	3.80	8.43	37.00

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Nitric Acid ....1/2 acid and water
Sulphuric Acid ....1/4 acid and water

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Corrosion of Brass in Humid Ammonia Atmosphere (Korrosion von Messing in Feuchter Ammoniak-Atmosphäre). J. Czochralski & H. Schreiber. *Korrosion u. Metallschutz,* Vol. 13, June 1937, pp. 181-183. Recent investigations of the cracking of cold-deformed brass parts have revealed that, besides existing interior stresses and the degree of rolling and working, the presence of humid ammonia vapors and air is important in the destruction of brass. The cracks run usually along the alpha-crystal boundaries. The action was much weaker in tombac where the intercrystalline corrosion was limited to a thin exterior layer. Ha (13)

Recent Soviet-Russian Work in the Field of Corrosion Protection for Chemical Apparatus (Neue Sovietrussische Arbeiten auf dem Gebiete des korrosionsschutzes chemischer Apparate). M. V. Pohl. *Korrosion u. Metallschutz,* Vol. 13, Mar. 1937, pp. 97-102. Review. Metals and alloys are discussed and compositions for particular application with certain chemicals given; protection by lining with silicates and rubber, electrolytic Pb-lining, and many examples of corrosion in various industries are mentioned, with bibliography. See also *Metals and Alloys,* Vol. 8, Apr. 1937, p. MA222R/2. Ha (13)

Corrosion of Non-ferrous Metals and Alloys, Report of A.S.T.M. Committee B-3. T. S. Fuller, Chairman. *Am. Soc. Testing Materials.* Preprint for June 1937 meeting, 2 pp. Progress report. Subcommittee VI on Atmospheric Corrosion has decided to remove the next series of specimens of non-ferrous metals and alloys during 1937. VVK (13)

Nitrogen Absorbed by Steel When Lubrication Fails. Hans Diergarten (SKF). *Metal Progress,* Vol. 31, Apr. 1937, pp. 414-416. Notes on the original work of H. Schottky & H. Hiltenkamp, *(Metals and Alloys,* Vol. 7, Oct. 1936, p. MA508R/7) indicating that worn spots show up to 0.12% N_2 while the interior and unworn surfaces both show only 0.004%. H. J. Wiester (*Metals and Alloys,* Vol. 7, Aug. 1936, p. MA 414L/6) reports coarse grinding may increase N_2 from 0.01% to 0.09%. WLC (13)

Surface Protection of Light Metals (Oberflachenschutz von Leichmetallen). A. Koppenhofer. *Metallwirtschaft,* Vol. 16, Apr. 30, 1937, pp. 417-419. A general report on the protection of Al and Mg alloys against corrosion. GA (13)

A New Test for Relative Sliding Wear. Donald S. Clark & Robert B. Freeman (Calif. Inst. Tech.). *Metal Progress,* Vol. 31, Apr. 1937, pp. 399-401. Original work describing a device for measuring the force required to remove a measured amount of metal by the sliding action of a weighted timed point. Data are given showing energy per unit of metal removed at different loads for nitrided nitralloy and stellite. With varying loads the curves are parallel, nitralloy showing the higher energy requirement to remove metal. This method differs from previous attempts to correlate scratch hardness with sliding wear in that it uses the energy rather than the width of scratch. See also *Metals and Alloys,* Vol. 8, Feb. 1937, p. MA 95R/10. WLC (13)

Best Tests for Corrosion and Electroplates. William Blum. *Metal Progress,* Vol. 31, Apr. 1937, pp. 386-388. Briefly reviews 6 papers presented at March Meeting of A.S.T.M. on Corrosion Testing. Only after long experience can a given corrosion test be used as a criterion of service, and then it becomes a "special property test." All corrosion tests are highly empirical and many variables are not adequately controlled. Atmospheric corrosion tests require more data on climatic conditions and air pollution at the site. Salt spray tests require consideration of design and operation of spray, control of temperature, strength, purity and H ion concentration of the solution. Alternate immersion and water line tests, total immersion tests and soil tests are discussed in separate papers summarized. Atmospheric tests of electroplated coatings, color photographs of corroded metal and magnetic tests for thickness of electroplate are discussed. WLC (13)

Testing of Corrosion Resistance of Welds (Die Prüfung des Korrosionswiderstandes von Schweissverbindungen) Res. Lab. AGIL Schweissverfahren Dr. Vaas. *Schiffbau,* Vol. 38, Mar. 1, 1937, pp. 75-79. Original research. A corrosion tester for welded samples is described and testing results are reported. The samples are intermittently submerged while the vessels holding the corrosion medium are rotated. The main object of the test is to determine qualitatively whether weld and parent metal withstand corrosion to a vastly different extent. The corrosion tests on welds made with 3 different electrodes and tested in 30% HCl indicate the advisability of using coated electrodes. Welds can be made to possess a greater corrosion resistance than the surrounding metal. Chemical analyses are given. EF (13)

Corrosion in Neutral Solutions with Particular Reference to the Rusting of Iron and Steel (Korrosion i neutrala Lösningar med speciell Hänsyn till järnets Rostning) Sven Brennert. *Tek. Tid.,* Vol. 67, Jan. 9, 1937 (Section *Kemi*), pp. 1-8. Metals like Fe and Al are protected by a surface film of oxides, hydrates and similar compounds; these are generally cathodic. Certain factors have a favorable action on this surface film, others are harmful. The film is not absolutely impervious, and when the metal is submerged in a solution the liquid will immediately fill the pores and form hydrates, sulphates, chlorides, or any other salts depending upon the nature of the liquid. To prevent corrosion it is then necessary to cause a precipitation of heavily soluble salts in the pores, such as ferric hydrate. Strongly oxidizing solutions often exert a passivating action by converting soluble ferro compounds into insoluble ferric hydroxide. Addition of a strong base may have the same effect. Parts of the surface resting against a foreign material, such as glass, rubber, or wood show tendency to corrode, probably because access of oxygen to the surface is obstructed. Inclusions in the metal will reduce its resistance to corrosion; cold working has the same effect. Various methods of corrosion protection are discussed, such as metallic coatings, paints, and additions of inhibitors to the solution. BHS (13)

Corrosion of Steel by Oil Well Waste Waters. W. F. Rogers & W. A. Shellshear (Gulf Oil Corp., Houston, Tex.). *Ind. Eng. Chem.,* Vol. 29, Feb. 1937, pp. 160-166. Original research. Useful data from the study of conditions governing corrosion rate of oil well subsurface equipment are given. Oil waste waters increase corrosion rate when they contain O_2, or when the pH of H_2S-bearing waters is decreased from 6.8 to 5.4. In the case of O_2-bearing waters, increasing the oil content decreases corrosion rate. MEH (13)

Corrodibility of Aluminum Alloys. Hideo Nishimura. *Sui-yokwai-Sshi,* Vol. 9, Feb. 1937, pp. 141-152. Original research. Corrosion of Al alloys in NaCl or dil. HCl solution was examined by measuring weight change and gas evolution. The corrodibility of Al alloys containing Mg as principal alloying constituent is decreased to that of commercially pure Al by 0.5% Mn, but Sb and Zn are without beneficial effect. Alloys containing about 1.5% Mn and 0.3% Cr, however, are attacked less than commercially pure Al. HN (13)

Influence of Antimony Addition on Chemical Stability of Aluminum Casting Alloys. M. P. Slavinski & N. T. Blinova. *Metallurg,* Vol. 11, Dec. 1936, pp. 95-101. In Russian. Summary of literature data. Al alloys containing Sb in small amounts have a better resistance to sea water due to the formation of a film of complex Sb oxides. (13)

Oxidizability of Nickel (Complément sur l'oxydabilité du nickel) Gabriel Valensi. *Bull. Soc. Chim.,* Vol. 4, Series 5, Mar. 1937, pp. 405-415. Original research. The effect of the composition of the gas phase and of the origin and purity of the metal on the rate of oxidation at elevated temperatures was studied. After annealing in vacuum, pure Ni (99.6% Ni, .2% Co, .18% Fe + Mn, .008% S, trace Si and Mg) and commercial Ni (98.7% Ni, .18% Co, .42% Cu, .6% Fe + Mn, .04% Si, trace C) start to oxidize around 550° C. The rate of oxidation was found to be the same for both materials at relatively high temperatures, while the beginning of oxidation was somewhat lower in the less pure grade. Cold working, polishing and H_2 annealing exert no influence. No difference in rate of oxidation was found in O_2 and in air, but H_2O catalytically accelerates oxidation. "Caledonickel" (98.64% Ni, 1.1% Co, .135% Fe, .044% Cu, .027% C, .011% S, .04% Si, .001% As, trace Mn) is very sensitive to the action of O_2 if it has not been melted. The factors which actually influence the oxidation rate of Ni are very few. The author's findings are partly in disagreement with previous experiments, which are cited in detail. EF (13)

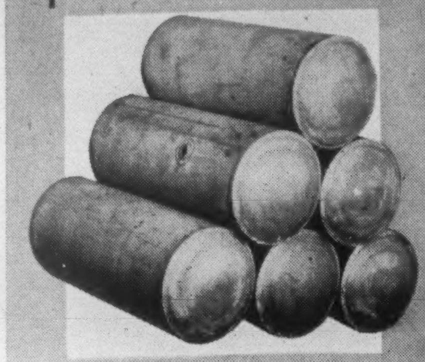
Some Consequences of Graphitic Corrosion of Cast Iron. W. A. Wesley, H. R. Copson & F. L. Laque (Int. Nickel Co.). *Metals and Alloys,* Vol. 7, Dec. 1936, pp. 325-329. Review plus original research. A graphitized layer upon cast Fe may by its galvanic action accelerate the corrosion of the cast Fe base or of any uncoated Fe in contact with it. Thickness and porosity of the graphitized layer determine its galvanic action. The galvanic action is minimized by making a bare metal part in contact with graphitized Fe of an alloy cast Fe. GEG (13)

Fundamental Principles of Metallic Corrosion. U. R. Evans (Univ. Cambridge). *Iron & Coal Trades Rev.,* Vol. 134, Mar. 12, 1937, pp. 493-494. *Iron Age,* Vol. 139, Apr. 15, 1937, pp. 46-48, 116-118; Apr. 22, pp. 43, 58-59. Review. Chemical and electrochemical corrosion are explained, method of determining degree of oxidation discussed, and protective measures for metals by coating, spraying, phosphating reviewed. Ha + VSP (13)

This Versatile Metal May Solve Your Problem

HERCULOY*

1



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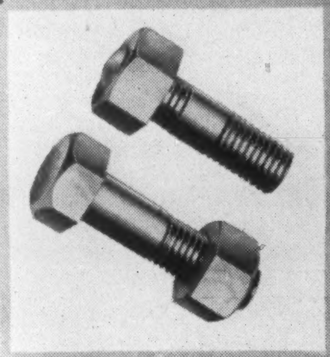

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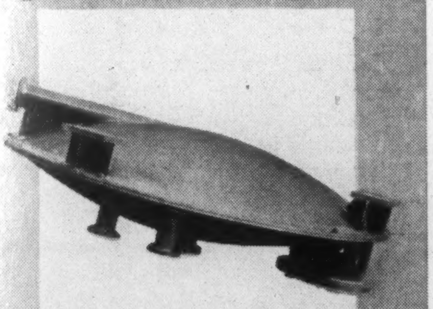

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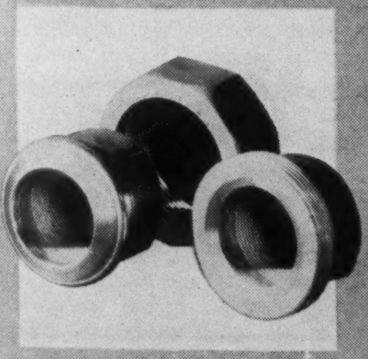

Herculoy is the name of a group of improved silicon-copper alloys as manufactured by Revere Copper and Brass Incorporated. These alloys combine the strength of steel with the corrosion resistance of copper. Herculoy is made in four principal compositions and can be cut, spun, stamped, drawn, hot and cold forged, welded or otherwise manipulated by standard fabricating processes. It is non-magnetic, has low thermal and electrical conductivity, has a pleasing gold color and is capable of taking a handsome finish. Herculoy is available in the form of hot rolled, cold rolled or cold rolled and annealed sheets, plates, rolls and strips; hot rolled and cold drawn rods, bars and shafting; tubes; welding rods; and ingots for sand casting.

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4. Herculoy pipe union seats.

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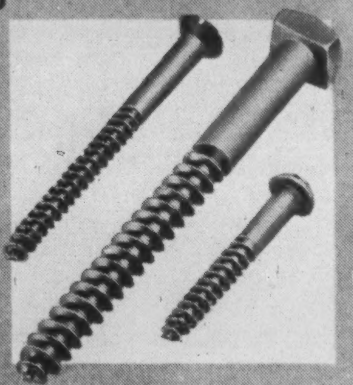
8. Herculoy packing gun cylinder for steam plant unit.

5



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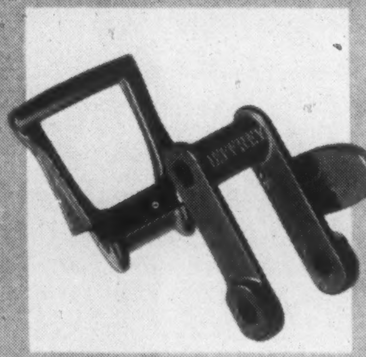

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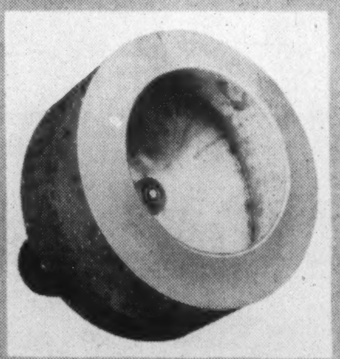

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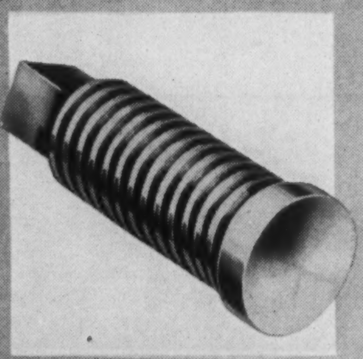

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Results of Questionnaires on Corrosion of Gas Pipes (Ergebnis der Umfrage über Korrosionen in Gasleitungen) K. Bunte & P. Struck. *Gas- u. Wasserfach,* Vol. 80, Apr. 24, 1937, pp. 262-268. Conclusions drawn from the replies to 687 questionnaires were statistically evaluated. The corrosion of cast Fe or steel pipe is mainly a matter of good insulation. 73% of all destructions were ascribed to chemical attack by the soil; a certain soil pH value should not be exceeded. The magnitude of this pH requires further investigation. 8 references. Ha (13)

The Oil Corrosion Problem. Gustav Egloff (Universal Oil Products Co.). *Refiner Natural Gasoline Mfr.,* Vol. 16, Mar. 1937, pp. 99-100. A general discussion of the extent of corrosion in the oil industry. VVK (13)

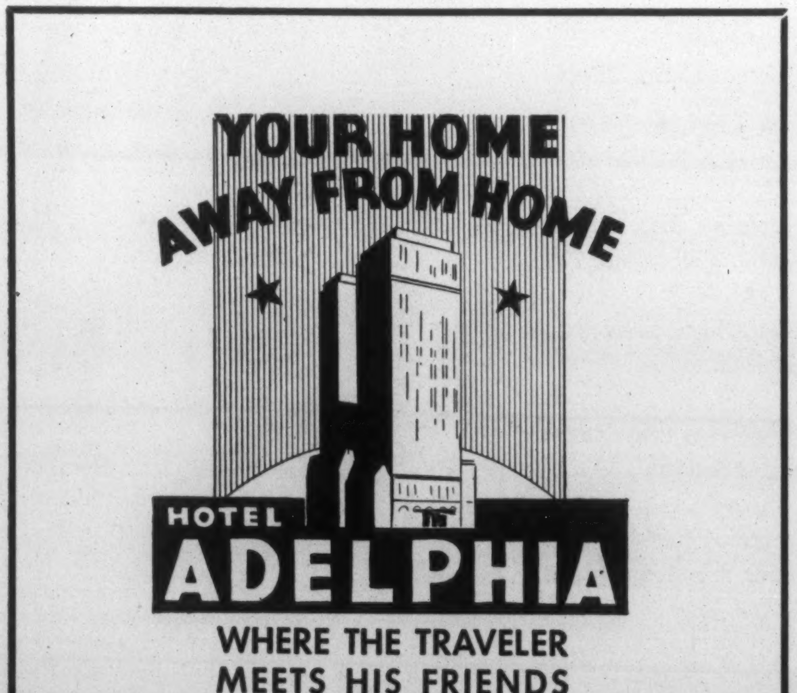
The Newer Bearing Materials and their Lubrication. H. C. Mougey. *Proc. Am. Petroleum Inst.,* Vol. 17 (III), Nov. 1936, pp. 42-48; discussion, pp. 48-49. *Natl. Petroleum News,* Vol. 28, Nov. 11, 1936, pp. 31-36. See *Metals and Alloys,* Vol. 8, Mar. 1937, p. MA 171L/4. VVK (13)

The Rusting of Steel Surfaces in Contact. T. Lonsdale. *Mech. World Eng. Record,* Vol. 101, Feb. 12, 1937, pp. 149-150. Discussion by Harry Shaw, Mar. 5, 1937, p. 253. Explains occurrence, production and probable mechanism of the dry rust phenomenon. EF (13)

Field Inspection Practices in Turbine Maintenance. John M. Dodds (General Elec. Co.) *Elec. West,* Vol. 78, May 1937, pp. 27-30. Report presented before Operating Economics Section, Pacific Coast Elec. Assoc. Includes consideration of corrosion and erosion in steam turbines. MS (13)

An Aluminium Statue of 1893: Gilbert's "Eros." R. S. Hutton & R. Seligman. *Engineer,* Vol. 163, Mar. 19, 1937, pp. 329-330. *Engineering,* Vol. 143, Mar. 26, 1937, p. 337. See *Metals and Alloys,* Vol. 8, July 1937, p. MA441L/4. LFM (13)

Painting of Metals. J. C. Hudson. *Chem. Trade J.,* Vol. 100, Apr. 23, 1937, p. 359. Outlines results so far obtained by the Corrosion Committee of the Iron and Steel Inst. in its investigation of the protection of ferrous metals by paints. MS (13)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HOTEL
ADELPHIA
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FOUR RESTAURANTS
Floor Show at Supper, Dinner and Saturday Matinee
NEAREST EVERYTHING.
CHESTNUT at 13th ST.
PHILADELPHIA

Electrical Instruments Applied to the Study of Pipe-line Corrosion. J. M. Pearson (Susquehanna Pipe Line Co. Phila. Pa.) *Proc. Am. Petroleum Inst.,* Vol. 16, (IV), 1935, pp. 75-80. Descriptive. By the use of certain instrument refinements, the precision and reproducibility of electrolysis measurements can be brought up to good engineering standards. By suitable correlation of simultaneous readings, stray current circuits can be traced, and quantitatively closed. By measurement of the constants of the network carrying the offending currents additional members of the network can be designed to redistribute the current flow in such a way that most hazards can be eliminated, and in some cases positive cathodic protection can be obtained, if desired. Effects of drainage on other structures can be calculated, and the structures can be suitably protected. Quantitative measurements of results obtainable by a given remedial measure can be made. VVK (13)

Metallizing for Prevention of Corrosion. W. C. Reid (Metallizing Engineering Co.) *Metallizer,* Vol. 5, Dec.-Jan. 1937, pp. 4-5. Practical. Metal spraying with Zn is one of the most effective ways of preventing corrosion of large fabricated structures although many other metals may be sprayed for special purposes. See *Metals and Alloys,* Vol. 7, June 1936, p. MA 318L/2. BWG (13)

Mechanism of the Corrosion of Metals. E. G. Rollason. *Welder,* Vol. 9, Feb. 1937, pp. 53-58, 61. General review of theory and corrosion behavior of various metals and of methods for protecting Fe. WB (13)

Factors Influencing Wear of Valve Seats in Internal-combustion Engines. C. G. Williams. *Engineering,* Vol. 143, Mar. 26, 1937, pp. 357-358. Summarizes the results reached in a complete investigation carried out in the laboratories of the Inst. Automobile Engrs. LFM (13)

Copper and Copper-base Alloys in the Construction of Corrosion-resisting Equipment and Structures. R. A. Wilkins (Revere Copper & Brass, Inc.) *Refiner Natural Gasoline Mfr.,* Vol. 16, Mar. 1937, pp. 119-130. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 440R/7. VVK (13)

Corrosion-resistant Metals. F. N. Speller (National Tube Co.) *Refiner Natural Gasoline Mfr.,* Vol. 16, Mar. 1937, pp. 105-107. General review of the principles of corrosion. No one metal or general remedy for all kinds of corrosion is likely to be found. Corrosion is essentially an economic problem the answer to which may be to let the structure alone and recondition when necessary, as is often the practice in buried pipe lines; to apply a coating of a more resistant material; to condition the environment so that it will be less active; or to select the metal or alloy best adapted to the particular conditions of service at the lowest consistent cost. See *Metals and Alloys,* Vol. 8, July 1937, p. MA 440R/7. VVK (13)

Sugar as an Inhibitor of Corrosion. H. C. S. de Whalley. *Chemistry & Industry,* Vol. 56, June 19, 1937, pp. 569-570. According to an "English Food Investigation Report" crude or refined beet sugars inhibit corrosion of Fe to varying extents. The inhibitive substances, although not isolated or identified, are believed to be breakdown products or other impurities, possibly metallic sucrosides. AAA (13)

Plastics Fortify Against Corrosion. Archie J. Weith (Bakelite Corp.). *Ind. Eng. Chem.,* Vol. 29, Apr. 1937, pp. 380-384. Survey. This article enumerates some of the many possibilities in replacing metals and alloys by plastics of the phenolic resin type, affording a high degree of corrosion resistance. One example is the use of heavy-duty phenolic laminated bearings in the steel industry in place of the usual metal bearings. For coating metals, choice of the correct plastic involves not only the most resistant plastic but also the question of its application to the surface to be protected. Where steel or other metal pipes are to be immersed in corrosive liquids, plastic coatings render quite satisfactory protection, and even under severe conditions, the strength of the coated piece suffers little. MEH (13)

The Resistance of Cast Iron to Alkaline Corrosion. H. Tanimura & M. Yayoshi (Kyushu Imp. U.). *Tetsu-to-Hagane,* Vol. 23, Jan. 25, 1937, pp. 46-50. In Japanese. Original research. Influence of several alloying elements on the corrosion resistance of cast Fe in molten bath of NaOH is studied. Si markedly decreases corrosion resistance and the greater the Si content the less the resistance. Ni, Cu, and Al increase the corrosion resistance, provided that Si content is low. Cr and S tend to increase the resistance, while C and Mn have no appreciable influence. P is beneficial. NS (13)

14. APPLICATION OF METALS AND ALLOYS

When Specifying Alloys for Equipment One Should Know Something of the Analyses and Qualities of Those Available. *Eng. Mining J.*, Vol. 138, May 1937, pp. 239-240. Tables show the analysis and typical application of ferrous alloys used; for resistance to oxidation, heat and corrosion, resistance to impact and abrasion, and for strength, toughness and ductility. WHB (14)

Molybdenum. *Times Trade and Eng.*, New Series, Vol. 41, June 1937, p. 32. Outlines methods of producing pure Mo, ferro-Mo, and other forms, and their varied industrial applications. MS (14)

Metallic Vitamins. Zay Jeffries (General Elec. Co.) *Steel*, Vol. 100, May 24, 1937, pp. 42, 44. Discusses special elements in metallurgy. MS (14)

Transmission of Heat through Metal Walls. R. E. Light. *Power & Works Engr.*, Vol. 32, Mar. 1937, pp. 108-112. Comprehensive review, giving tables and charts for calculating heat transmission values. 12 references. FPP (14)

14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

A Standard Element for Small Voltages (Ueber ein Normalelement von kleiner Spannung) W. Gremmer (Phys. Tech. Reichsanstalt) *Physik Z.*, Vol. 20, Oct. 15, 1936, pp. 697-699. Original research. Reports on the development of a standard cell suitable for work with resistance thermometers and thermo-couples. The underlying principle is explained on the basis of the binary constitutional diagram Cd-Hg. Testing results covering a period of 1½ yrs. are presented. The voltage of the cell lies between 0.04463 and 0.04470 volt at 18° C. and the temperature coeff. is —0.00026 volt/1° C. The voltage drops slightly during the first 3 mos. The cell voltage is much smaller than that of the Weston element. EF (14a)

On the **Aluminum Coating of Telescope Mirrors (Ueber die Veraluminierung von Teleskopspiegeln)** W. Grotrian. *Naturwissenschaften*, Vol. 25, Mar. 12, 1937, pp. 175-176. Descriptive. Al has been supplanting Ag for the coating of telescope mirrors for the following reasons: (1) The original reflectivity of Al is about 5% lower than that of Ag, but it remains unchanged with time; whereas the reflectivity of Ag decreases almost to zero in time. (2) The Ag mirrors must be continually resilvered, but the Al mirrors can be restored by washing. (3) Al has a much higher reflectivity than Ag in the ultra-violet region, although Ag is higher in the infra-red range. The mirrors are coated by evaporating Al or an Al alloy in a high vacuum and letting it condense on the mirror. Sharper lines are obtained when the Al is not polished. JBZ (14a)

Powdered Aluminum and Its Practical Application (Aluminiumpulver och dess praktiska användning) Valde Oskarson. *Tek. Tid.*, Vol. 67, May 8, 1937 (Section *Kemi*) pp. 33-37. Discusses the production of Al powder, the analysis and properties of the common commercial grades, and the most common uses. The most important outlets are in paints and protective coatings, thermit welding, and calorizing. Al powder is also used in explosives, in printing, photography, pyrotechnics, in the metallurgical treatment of Au and Ag ores, for precipitation from cyanide solutions, and in light weight concrete. BHS (14a)

The Combustion Light of Some Metals (Studien über das Verbrennungslicht einiger Metalle) J. A. M. van Liempt & J. A. de Vriend (N. V. Philips Gloilampenfabrieken). *Rec. Trav. Chim.*, Vol. 56, Jan. 15, 1937, pp. 126-129. In German. Original research. Continuing previous work on the combustion of Zr, Mg and Al (see *Metals and Alloys*, Vol. 6, Jan. 1935, pp. MA 40R/5, 40R/6; Sept. 1935, p. MA 376R/4) the amount of light and the light yield during the combustion of W, Mo, Ta, Ce and C were experimentally determined, with the following results.

W	Mo	Ta	Ce	C	
1.056	1.88	1.373	1.661	7.833	cal./mg.
9.0	8.7	32	9.3	1.9	lm/W

EF (14a)

Production of Magnesium Metal and Magnesium Alloys in Different Countries (Framställning av magnesiumlegeringar i olika länder) *Tek. Tid.*, Vol. 67, Apr. 10, 1937, (Section *Bergsvetenskap*) pp. 32-34. A brief review giving the world's most important Mg producers. Practically all commercial Mg is made by electrolysis of $MgCl_2$. About 2/3 of the production is from magnesite, the remainder mainly from carnallite. Most Mg is sold in the form of high grade alloys, with 85-95% Mg. The other elements commonly contained in these alloys are Al, Zn, and Mn. Most important applications are in aircraft construction. BHS (14a)

Light Metal Instead of Nickel Silver (Leichtmetall statt Neusilber) H. Fischer. *Aluminium*, Vol. 19, May 1937, pp. 321-322. Wearing apparel accessories like buckles, clasps, etc. can be made advantageously of an Al-Mg-Si alloy instead of nickel-silver. Ha (14a)

Properties of Pure Chromium (Eigenschaften von reinem Chrom) A. Schulze. *Z. Ver. deut. Ing.*, Vol. 81, Apr. 10, 1937, pp. 442-443. Literature review, 6 references. Ha (14a)

Anti-friction Bearing Alloys. G. J. Brittingham (Elec. Ref. & Smelt. Co., Australia). *Commonwealth Engr.*, Vol. 24, Jan. 1, 1937, pp. 211-214. General review classifying bearing alloys according to composition and discussion of their properties and applications. Reference is made to Sn and Pb-base alloys, leaded bronzes, Cd-base alloys and to laminated plastic bearings. EF (14a)

The Development of a New Aluminum Cable Joint for House Service Connection (Versuche zur Entwicklung einer neuen Aluminium-Kabelabzweigklemme für Hausanschlüsse) Willy Gebauer. *Elektrizitätswirtschaft*, Vol. 35, Sept 25, 1936, pp. 694-698; Oct. 15, 1936, pp. 745-750. Detailed illustrated report on original research. The new coupling for Al power lines is submitted to extensive tests, the results of which are reported in full detail. EF (14a)

Preparation of "Raneys Nickel" (Sur la Préparation de "Raneys Nickel") R. Paul & G. Hilly. *Bull. Soc. Chim.*, Vol. 3, Dec. 1936, pp. 2330-2332. Descriptive. The proper amounts of Ni required for the formation of the intermetallic compound $NiAl_2$ or $NiAl_3$ is added to an Al bath heated to 1200° C. The brittle compounds are pulverized and treated with a 25% NaOH solution at 105° C. The catalytic efficiency of the Ni powder produced by this method is unusually great. EF (14a)

Metal Spraying on Wood. *Metallizer*, Vol. 5, Dec.-Jan. 1937, p. 10. Review of original research. Tests made in India to find to what extent wood sprayed with various metals is protected against changes in moisture content and dimensions, showed sprayed coatings of metals of low melting point (Sn, Zn, Pb) to reduce by a half to a third the susceptibility of wood to changes in moisture content with variations in humidity. High melting point metals or alloys (bronze, brass, Cu, Al) do not protect wood appreciably. None of the coatings would protect wood against water absorption when actually soaking the wood in water. BWG (14a)

14b. Ferrous

M. GENSAMER, SECTION EDITOR

Modern Tools of High Speed. W. F. Frazer (Union Twist Drill). *Metal Progress*, Vol. 30, Dec. 1936, pp. 41-44. General review. 18-4-1 high speed steel with improved mill practice and heat treatment is still the best "general purpose tool steel." The "special purpose high speed steels" with Mo or Co contents have either less red hardness or lower impact resistance. GEG (14b)

Forged Versus Cast Crankshafts. Georg Goldbach. *Heat Treating Forging*, Vol. 23, Mar. 1937, pp. 127-128. Summarizes endurance tests, carried out at the Tech. Hochschule, Darmstadt, on single-throw crank-shafts of C steel, pearlitic cast-Fe, and black-heart malleable Fe. Torsional endurance limit of cast-Fe and malleable shafts was about 65% and 70%, respectively, of that of forged steel shafts. MS (14b)

Steels for Autoclaves (La qualité des aciers à employer dans la construction des autoclaves) CH. BERTHELOT. *Rev. Mét.*, Vol. 34, Mar. 1937, pp. 238-249. A summary of published data based mostly on work of R. J. Sarjant & T. H. Middleham. (See *Metals and Alloys*, Vol. 7, Nov. 1936, p. MA 546L/1. JDG (14b)

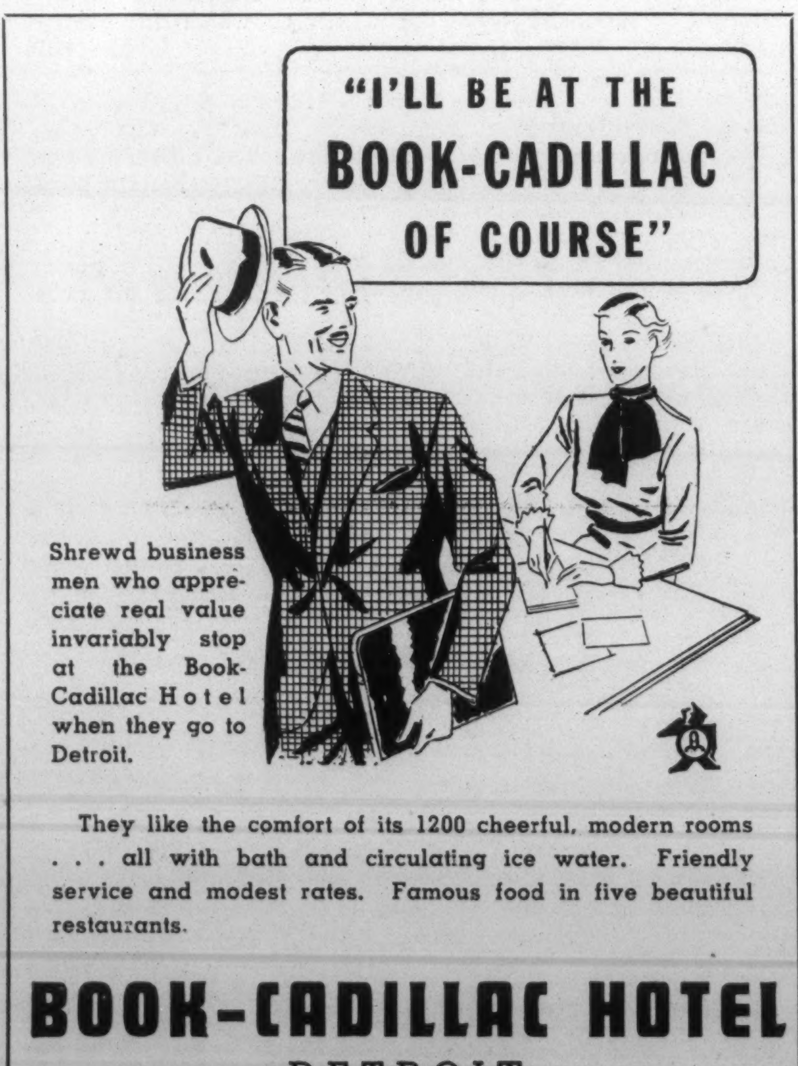
Materials for Corrosion Resistance. R. H. BERRIMAN. *Commonwealth Engr.*, Vol. 24, Sept. 1, 1936, pp. 51-56. General review. Considers the various corrosive substances (mostly sulphates) occurring in the production of electrolytic Zn and Cd from Broken Hill ores as carried out at Risdon, Australia and the usefulness of the following materials employed for corrosion resistance in this plant: timber, Sn-bronze, Al-bronze (Cu-Al-Fe, Cu-Al-Si), hard Pb, austenitic stainless steel, high Si-iron, cast Fe and semi-steel, rubber, molded plastics. Difficulties with materials in contact with molten Zn, and heat resistant alloys are specially treated. EF (14b)

Structural Steels. Manufacture, Properties and Applications. H. J. VOGAN (Univ. Sidney). *Commonwealth Engr.*, Vol. 24, Sept. 1, 1936, pp. 43-51. Up-to-date review. Treats in a general manner manufacture, structure, physical properties (ultimate tensile strength, plasticity, ductility, impact notched bar test, quality factor) and discusses in special chapters Ni steel, Si steel, Mn steel, Cr and more complex structural steels. EF (14b)

Alloy Steels Help in Redesign. *Steel,* Vol. 100, Mar. 22, drag-lines, Diesel power units, and automatic buckets. Much welded construction employed. Large engine has either a cast-1937, p. 44. Alloy steels made possible improvements in walking steel or an all-welded bed. MS (14b)

Malleable Crosses New Bridge. *Iron Age,* Vol. 139, May 6, 1937, pp. 50-51. Brief consideration of the use of malleable cast Fe as guard railing posts and panels for these railings in bridge construction. Includes a number of other uses. VSP (14b)

Transport Problems Discussed. *Electrical Rev.* Vol. 120, June 18, 1937, p. 925. Report of conference of Tramways, Light Railways and Transport Association. "Edinburgh's Municipal Transport System" by R. McLeod includes discussion of arc welding of rails and use of special steel rails. So far, Si steel rails have given most satisfaction with regard to wear. MS (14b)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15. GENERAL

Radium and Uranium—Canadian Production to Dominate. *Can. Chem. Met.*, Vol. 21, Mar. 1937, pp. 84-85. The Eldorado Mines, Ltd. is to increase the size of refinery operations at Port Hope to a point whereby 5-6 g. per month of Ra may be produced from an ore yielding 1 g. Ra per 6-7 tons of concentrate. Successive steps in the separation of Ra and Ur are indicated. WHB (15)

Skilled Labor Shortage Stimulates Steel Castings Demand. W. J. CORBETT (Atlas Steel Casting Co.) *Iron Age,* Vol. 139, Apr. 29, 1937, pp. 54-57. General discussion of the effect of skilled labor and increased wages on metal working industry. Among them is an increased appreciation and demand for steel castings where they are best suited. Consider some of the desirable properties of steel castings. VSP (15)

Smelting and Refining in Great Britain; The Future of Domestic Supplies. L. B. HUNT. *Metal Ind.*, London, Vol. 50, Jan. 15, 1937, pp. 64-70. Statistical survey. RWB (15)

Metallurgy of the Minerals of the Congo (La Métallurgie des Minerais Congolais) M. REY. *Rev. Universelle Mines,* Vol. 13, Mar. 1937, pp. 115-121. Brief history of the discoveries and developments of minerals of metallurgical value found in the Congo State is given. The metals, Cu, Au, Sn, Ag, Co, Ra, Ur, Pt and Pd, and their production are covered. While formerly smelting and concentrating were the principal methods, electrochemical treatment has predominated since 1929. Location and operation of some plants are described. Ha (15)

Ferro-alloys. A. A. ROBERTSON. *Commonwealth Engr.*, Vol. 24, Nov. 2, 1936, pp. 139-140. Australian requirements and resources of Fe-Si, Fe-Cr, Fe-Ti, Fe-W, Fe-Mo, Mo-Ca, Fe-V, Fe-Zr, Fe-P, Al, Ni, Cr. EF (15)

Story of Tin Cans. *Tin,* Feb. 1937, pp. 3-6. Reproduced from "Steel Facts," Am. Iron & Steel Inst. History of making tinned articles is traced from early Roman time to present use of the most modern equipment known to steel manufacture. About 58 man-hrs. of labor is still required to produce a ton of Sn plate, more than for any other finished rolled steel product. Half of the world's production of Sn plate is made in the U. S. BWG (15)

Columbite. R. T. HANCOCK. *Can. Mining J.*, Vol. 58, May 1937, pp. 240-241. Columbite is associated with granite or acidic magmas and may be found in the metamorphic aureole surrounding a granite intrusion. It is difficult to identify in the field. It makes a streak not quite black, not quite brown with a greenish tinge. It is more brilliant than ilmenite and harder. If a sample of mixed alluvial minerals is treated with an electromagnet, the strength of which can be varied, magnetite comes off first, then ilmenite, then garnet, then columbite, leaving casserite. WHB (15)

The New Regulations on Applications of Metals (Die neuen Metallverwendungsverbote) *Chem. Fabrik,* Vol. 10, Jan. 6, 1937, pp. 22-24. Resumé of recent German promulgations restricting the use of certain non-ferrous (non-domestic) metals to certain applications and specifying the permissible exceptions. FPP (15)

Sulphide Ores of the Levikha Deposits in the Urals. A. V. EFREMOV & A. A. PETROV. *Tsvetnye Metal.*, No. 2, Feb.-Mar. 1936, pp. 4-40. A detailed description of the origin and geological structure of the Cu-Zn ore deposits at Levikha, Urals. The results of exploration are described in detail. The metal resources are estimated as follows: Cu 152,000 tons, Zn 194,000 tons. BND (15)

Belousov Zinc-copper Deposits in the Altai Mountains. A. AMIROSLANOV. *Tsvetnye Metal.*, No. 1, Jan. 1936, pp. 41-60. In Russian. The Belousov Cu-Zn-Pb ore deposit is one of the largest in the Altai District. The deposit has been worked for many years, although its geology and extent have never been accurately determined. The author gives results of preliminary systematic study of the deposit. According to his estimates the metal resources of the ore body are as follows: total ore, available and probable 11 million tons with average metal content of 2.43% Cu, 7.59% Zn and 1.7% Pb. Total metal content: 269,000 tons Cu, 842,000 tons Zn, and 188,000 tons Pb. BND (15)

15a. Economic

Russian Iron Production and Exports. *Engineer,* Vol. 163, Feb. 19, 1937, p. 230. The Commissioner for Heavy Industries in Russia gives statistics for 1936 pig Fe production. Exports of 670,000 tons of pig Fe were made in 1936 as compared to 331,000 in 1935 and 115,000 in 1934. Japan received the bulk of this with England in second place. The total production of pig Fe amounted to 14.4 million metric tons, of steel 16.3 millions and of rolled products 12.3 million tons. As Japan becomes more self-sufficient, it is expected that the Russian production can be used for home consumption. LFM (15a)

Status of Steel Construction. Theory and Practice (Stand der Stahlbauweise. Theorie und Ausführung) H. MAIER-LEIBNITZ. *Z. Ver. deut. Ing.,* Vol. 81, Mar. 13, 1937, pp. 319-324. General survey. Ha (15a)

Statistical Bulletin. *Intern. Tin Research Development Council,* Vol. 5, Feb. 1937, 28 pp. Complete statistics given for 1936 production and consumption of Sn by countries, Sn stocks, prices, automobile production by countries, and statistical data given on Sn plate, babbitt and Sn foil. World consumption of Sn in 1936 was 10.3% over that of 1935; the U. S. increase was 21.4%. Germany has decreased her consumption of Sn by 18.8% in the past year, presumably by use of substitutes. Production of Sn in 1936, was highest in any year since 1929. The U. S. consumed 48% of the total world's consumption of Sn in 1936. BWG (15a)

Production of Radium. *Engineer,* Vol. 163, Mar. 26, 1937, p. 374. Short note commenting on the fact that the reduction in the price of Ra, which is reported to be cut in half, is due to the improvements in the production of Canadian Ra in the great Bear Lake district near the Arctic Circle. LFM (15a)

Mercury Industry in 1936—Advance Summary. H. M. MEYER. *U. S. Bur. Mines, Mineral Market Repts.* No. M. M. S. 547, May 27, 1937, 2 pp. Statistical. AHE (15a)

Manganese Ore Industry in 1936—Advance Summary. ROBERT H. RIDGWAY & H. W. DAVIS. *U. S. Bur. Mines, Mineral Market Rept.* No. M. M. S. 557, June 16, 1937, 4 pp. Statistical. AHE (15a)

Pig Iron and Ferro-alloy Industries in 1936—Advance Summary. ROBERT H. RIDGWAY & H. W. DAVIS. *U. S. Bur. Mines. Mineral Market Repts.* No. M. M. S. 560, June 16, 1937, 3 pp. Statistical. AHE (15a)

Tungsten Industry in 1936—Advance Summary. ROBERT H. RIDGWAY & H. W. DAVIS. *U. S. Bur. Mine, Mineral Market Repts.* No. M. M. S. 566, June 22, 1937, 2 pp. Statistical. AHE (15a)

Molybdenum Industry in 1936—Advance Summary. ROBERT H. RIDGWAY & H. W. DAVIS. *U. S. Bur. Mines, Mineral Market Repts.* No. M. M. S. 559, June 15, 1937, 2 pp. Statistical. AHE (15a)

15b. Historical

Japanese Bronzes (Bronzes Japonais) A. CHAPLET. *Cuivre et Laiton,* Vol. 10, May 30, 1937, pp. 235-237. Descriptive. Composition, casting technique and production of patina on old Japanese bronzes are described. Almost all contain Pb, quite a few also Ag which give them a comparatively low m.p., great fluidity, little shrinkage, smooth surface, great susceptibility to patina formation, but weak resistance to atmospheric influences. The largest statue ever cast is that of the Buddha of Nara, cast in 739 A.D., the head of which was renewed in the 17th century; 450,000 kg. of bronze were used. A table of composition of 15 different bronzes is given, and a few recipes for producing artificial patina in boiling solutions of water or vinegar are added. Ha (15b)

Ancient Chinese Castings. THOMAS T. READ (Columbia Univ.) *Foundry,* Vol. 65, June 1937, pp. 27, 74. *Trans. Am. Foundrymen's Assoc.,* Vol. 8, June 1937, pp. 30-34. Claims that the Chinese were the first to make Fe castings about 500 A.D., although there is evidence that cast Fe was in use for 1000 years before that. Most Fe castings prior to 500 A.D. were mostly objects of practical utility, and were remelted as soon as they became old-fashioned or marred. Bronze castings date from 1766-1122 B.C. VSP (15b)

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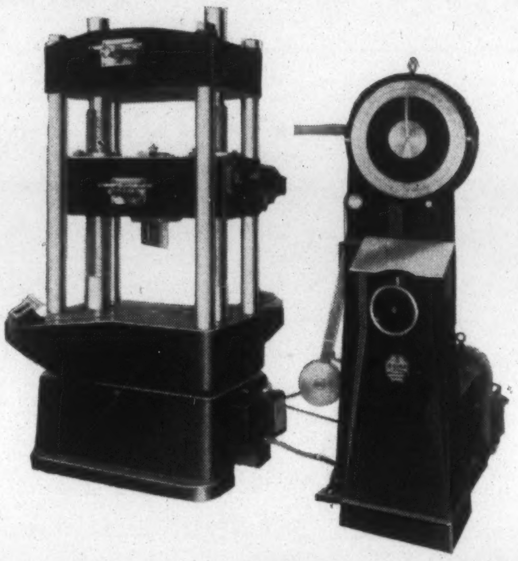

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WANTED: Superintendent for non-ferrous ingot smelting plant in Great Lakes district. Must be familiar with construction and operation of reverberatory furnace, production of red and yellow alloys, aluminum and white metals. Reply giving complete information as to experience, qualifications and salary expected, will be treated with absolute confidence. Box MA-48.

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Book Reviews

THE SCIENCE OF DENTAL MATERIALS

Eugene W. Skinner

W. B. Saunders Co., Philadelphia and London, 1936. Cloth, 6¼ x 9¼ in., 411 pages. Price $4.50.

Dr. Skinner is associate professor of physics, Northwestern University Dental School, and this book has as its primary motive the provision of a text book for a course in line with the report of the Curriculum Survey Committee, American Association of Dental Schools, (1935).

The book is a rather radical departure from the older books on dental metallurgy which contained principally a combination of process metallurgy and chemistry. As the title indicates this text book is directed to all of the materials used in dentistry so that not more than half of the book is on the subject of metals and alloys. The author has relied upon standard publications in dentistry, physical metallurgy and on the literature for the major part of his information. The American literature has been well covered but there is comparatively little reference to foreign literature. The up-to-date character of the information is illustrated by a discussion of the various types of resins for artificial dentures and of stainless steels for a similar use, although other denture materials which have recently been proposed, such as cast alloys of corrosion-resistant base metals, have not been included. The author has secured illustrations from various publications and from manufacturers of equipment and materials and has apparently drawn upon his own researches for some original material. The book is divided into 40 chapters which may well be used for lesson assignments for students although in some cases two chapters should be covered in a single period. The appendix of some 16 pages gives specifications of the American Dental Association.

The first 19 chapters are on non-metallic materials. Chapters 20 and 21 begin the work on metals and present a brief treatise of the fundamentals. Other chapters discuss gold foil, general alloy systems (briefly), corrosion of metals and alloys, wrought gold alloys, cast gold alloys, casting technique and procedures, joining of metals (gold and silver solders, fluxes and procedures), and dental amalgams. One chapter gives a very brief treatment of steel with special reference to dental instruments. This is probably the weakest chapter in the book but is possibly all that is required in this text because relatively few students or practicing dentists will make their own instruments. In addition there are chapters on stainless steel and its use in dentistry, the heat treatment of steel and the applications of stainless steel, and a chapter of a miscellaneous metallurgical nature on fusible alloys, gold technic metals, and other metals.

In general, each chapter is followed by literature references so as to make it possible for the student to consult original sources and in some cases to do collateral reading in other texts. The treatment of the subject material is decidedly of a more comprehensive and practical nature than in any book which has come to the reviewer's attention. The order of presentation seems reasonable, although should a teacher desire to change the order there should be no difficulty.

This book is undoubtedly best suited for use by students in dental colleges but it will have some interest to metallurgists in general and to those who are working with dental materials in particular. Dentists who have not had an adequate course on the science of dental materials might well profit by reading this publication.

The author has rendered a valuable service in collecting the widely scattered information and arranging it in usable form in a single volume.—OSCAR E. HARDER.

ALLOYS OF IRON AND CHROMIUM.—VOL. 1, LOW CHROMIUM.

A. B. Kinzel and W. Crafts

McGraw-Hill Book Co., New York, 1937. Cloth, 6 x 9 in., 535 pages. Price $6.00.

The Alloys of Iron monograph series has so far dealt with the metal Fe and its alloys with C, Si, Mo, W, and Cu. The present volume on Cr, a contribution of the Union Carbide and Carbon Research Laboratories, contains 186 figures, 159 tables and 478 references. It covers alloys up to 10 per cent Cr; the high Cr alloys, and those with Ni, V and Mn, as well as cast iron are to be dealt with in later volumes.

The preliminary search of the literature revealed some 9,000 articles dealing with the field of this book. The wheat has been winnowed from the chaff and the grain made into a palatable loaf by bakers who know their stuff.

The general pattern of the book is like that of the other monographs, brief historical treatment, description of the metal and the ferro alloys, a little discussion of melting problems, presentation of the Fe-Cr and Fe-Cr-C systems, with selection of best present data, a resumé of the general effects of Cr in iron and steel, information on properties of plain Cr and complex Cr steels, tool and die steels, and miscellaneous nitriding, magnet and other steels, a brief chapter on Cr cast iron, and a final chapter on the 5 per cent and 9 per cent Cr still tube steels.

At the end of each chapter the authors summarize the outstanding points in their own words. Where published data are incomplete, the gap is quite often filled by the inclusion of data from the files of the authors' laboratory.

This particular volume has been needed, even though Greaves "Chromium Steels" became available in 1935. The previous monographs have spoiled one for going back to a mass of detailed literature when a broad outline will serve. Although the second volume, in the monograph pattern, will be useful, we already have "The Book of Stainless Steels," and while the Fe-Ni and Fe-V monographs will be welcome, "Nickel Alloy Steels" and "Vanadium Irons and Steels," recently put out by the producers of those metals, cover the part of the field with which one is most often concerned. The worst gap now is the lack of similar comprehensive treatment of manganese as an alloying element. This is, of course, on the Iron Alloys Committee's program.

The present volume is the first one in the series that has been written by a producer of alloying elements. While now and then one can detect a trace of enthusiasm for a pet composition containing Cr over competing materials, this flavor is not marked; the general treatment is highly impartial.

This volume, like the previous ones of the series, is a valuable working tool which every metallurgist needs to have in his own bookcase, by his own desk.—H. W. GILLETT.

CREEP OF NON-FERROUS METALS AND ALLOYS—A REVIEW OF PUBLISHED INFORMATION.

W. A. Baker

British Non-Ferrous Metals Reseearch Association, London, 1937. Paper, 6 x 10 in., 19 pages. Price 2s.

This is the Association's Research Report R.R.A. 449; it is a correlated abstract, confined to creep tests of long duration and with loading low enough so that the creep rates approach those tolerable in service. Only a dozen publications contain data on non-ferrous alloys tested under these conditions. From this dozen, creep data are tabulated for Cu and Cd-Cu, Al and Pb at room temperature and at elevated temperatures for arsenical and argentiferous Cu, for a range of wrought brasses, for 88:10:2 and 88:6:4:2, phosphor bronze and Ambrac, for Monel and 80:20 Ni-Cr, and for 10 cast and wrought Al alloys.

In reviewing this we are torn between two fires. On the one hand it would seem that literature references might have been given to work at higher rates of loading, since such articles must have been surveyed in preparation of the abstract, and it seems a pity not to include them. We would have thought that the recent work on creep of Pb by Moore and co-workers at the Univ. of Ill. and that by Phillips in the 1936 *Proceedings* of the A.S.T.M. might at least have been mentioned, even if the articles in the March 1930 issue of METALS & ALLOYS are passed over.

On the other hand it is refreshing, and sets a good example, to have the Association come out flat-footed and insist that short-time or "accelerated" creep tests are valueless for appraising long-time load-carrying ability.

The data are not plotted, merely given in tabular form, and since they are expressed in deg. C. and tons/sq. in., the American reeader will have to convert them to the units in which he is accustomed to think.— H. W. GILLETT.

HANDBOOK OF INORGANIC CHEMISTRY—NICKEL COMPOUNDS *(Handbuch der anorganischen Chemie—Nickel Verbindungen)*

Edited by R. Abegg, F. Auerbach and I. Koppel

Vol. IV, Part 3, Section 4, Sub-section 1

S. Hirzel Verlag, Leipzig, 1937. Paper, 6¾ x 9½ in., 827 pages. Price 78 RM.

This is the first part of the section on nickel. The various chapters, their authors, and the number of pages (including bibliographies) are as follows: (1) Atomic Weight of Nickel, by J. Meyer, 17 pages; (2) The Nickel Atom, by E. Rabinowitsch, 61 pages; (3) The Metal Nickel, by W. Roman, 360 pages; (4) Compounds of Nickel, by A. Kurtenacker, 372 pages; (5) Colloid Chemistry of Nickel and its Compounds, by A. Kurtenacker, 8 pages. A subsequent volume (Sub-section 2) will include information on nickel alloys.

In this review, the intrinsic merits of that large part of the book dealing with purely chemical aspects are not considered, as it holds little interest for the metallurgist. The chapter on physics (2) dealing with the positive nucleus, orbital structure, spectra, magnetism and atomic size and mass variations may be consulted occasionally by research metallurgists.

Of the whole book, 360 pages are concerned with nickel, the metal; its occurrence, smelting, refining, commercial use and physical properties are covered. Appended to each chapter are the literature citations, which begin at 1694 and end early in 1936. The survey of the earliest literature is certainly a valuable asset of the handbook, but the list of recent publications is not complete. The more comprehensive and best known articles have naturally been emphasized, sometimes, however at the unfortunate expense of significant, but less conspicuous contributions. Furthermore, the discussion can hardly be called critical; much valuable information buried in the original contributions and not included in the summaries published in the papers is ignored, and in some cases (for instance, the section on recovery from cold work) original authors have been seriously misrepresented in the condensation of their work published in this book. The information is not available at the reader's fingertips, owing to the absence of an alphabetical index; also, the patent literature has been completely disregarded in the compilation.

These defects dwindle in importance, however, when we consider the work involved in piling up such a skyscraper of information. The really serious objection to this book, and to the "omnibus" type of handbook in general, is the uselessness of most of the volume to any given individual. The increasing tendency towards specialization means that no single reader can possibly be interested in more than a small portion of the volume, yet to acquire this he must pay a fancy price for an additional mountain of, to him, useless material.

Subdivision of the series into three or four rather than two sub-sections would have circumvented this objection. The present subdivision is described as necessitated by "äussere Gründe." Whatever these unfortunate external circumstances may have been, they certainly produce a deep internal dent in everybody's pocketbook.

It can be said, summarily, that the metallurgical section of the handbook has its distinctive merits. Unfortunately, development and research on nickel are progressing at such a rate that the handbook will probably soon be out of date.—ERICH FETZ.

REPORT FOR THE YEAR 1936—NATIONAL PHYSICAL LABORATORY

His Majesty's Stationery Office, London, 1937. Paper, 6 x 9½ in., 144 pages. Price 2s, 6d.

The activities of most direct metallurgical interest are in the engineering and the metallurgical departments. In the former, work is under way on endurance of crankshafts under complex stresses, mechanism of fatigue and corrosion fatigue, wear resistance, high temperature properties of metals and of bolts, and bearing clearances, among major projects. In the latter, the Fe-C, Fe-Ni and Fe-Mn systems, the solubility of S in solid Fe, alloys of Mg and of Al, creep of 0.15% C steel with and without 0.50% Mo, special cast irons at high temperatures, caustic embrittlement of boiler plates, and vacuum fusion and iodine methods for oxygen in steel are listed as major.

Most of the projects are of broad scope and continue over a period of years.—H. W. GILLETT.

TOOL STEEL DATA, INCLUDING ANALYSIS.

J. D. Hall

Tool Steel Printery, Lakewood, Ohio, 1937. Paper 4½ x 7 in., mimeographed, 70 pages. Price $2.50.

This pocket size book is aimed to inform the tool steel salesman what class of steel the brand name of a competing steel signifies, or to tell a purchaser what makes and brands of competing steels fall into the same classes. Types of steel are also suggested for a wide variety of uses.

The tool steel products of 18 firms in 625 brands are so listed. The A.S.M. Handbook lists 78 makers, agents or importers and 725 brands, with some duplications and Cone's list in *The Iron Age* for June 16, 1922 showed 600 brands. The other lists tell whether the brand is a carbon or an alloy steel and in some cases indicate the main alloying element, but do not sort the steels into classes.

Hall sets up some 50 classes and sub-classes grouped by type analysis. Even with so many classes the composition range is fairly wide, e.g., for the fast finishing class he gives the analysis as "over 1% C; Cr, 0.15—2%, W, 3—6.5%." Even this degree of sorting is helpful. Suggested forging, annealing, hardening and drawing temperatures are given for a few of the types, the recommendations sometimes deviating somewhat from the A.S.M. recommended practices for such steels, which is not to be wondered at considering the composition ranges covered in both cases.

A good deal of the information is available elsewhere, and Hall frankly states that the little book is a compilation. It's a handy one.

The foreword contains some interesting comment on factors influencing the choice of one type over another, among which the type of hardener and the equipment he has available bulks large; with each on the poor side a more expensive but more fool-proof steel would be justified.—H. W. GILLETT.

RECIPES FOR THE MACHINE AND METAL-WORKING INDUSTRIES *(Rezepte für die Maschinen-und Metallwaren-Industrie)*

4th EDITION

Hugo Krause

Max Jänecke Verlagsbuchhandlung, Leipzig, 1937. Paper, 5¾ x 8¼ in., 232 pages. Price 4.50 RM.

Comprises some 500 recipes, under the headings: casting; alloying; working of metals; hardening; tempering, etc.; soldering; gluing and cementing; surface polishing, protecting, coloring, etching and plating; and non-metallic materials.

These cover an extremely wide range of subjects. As examples, use of horse manure and substitutes therefor in loam molding, pattern metals, fluxes, bearing metals, statuary bronzes, salt baths, and soldering fluxes are dealt with. In some cases only glittering generalities are stated, as in the discussion of controlled atmospheres, but in many, rather specific instructions are given. The expert in any particular field could point out the inadequacy of the suggestions made, but the recipes are obviously not for the expert, and to those who have no idea how to do a thing the recommendation may be quite helpful. On the whole it is unlikely that metallurgists will find much of value in any book of just this type. —H. W. GILLETT.

MAGNESIUM ALLOY PATENTS *(Magnesium-Legierungen Patentsammlung)*

A. Grutzner, G. Apel and C. Gotze

Verlag Chemie, Berlin, 1937. Boards, 7 x 10¼ in., 192 pages. Price 15RM.

This volume is an Appendix to Gmelin's Handbuch der anorganischen Chemie. The compositions of Mg alloys covered by patents in U. S. A., England, Germany, France, Austria and Switzerland to the end of 1936 are given, so indexed that they can be found under each alloying element. Thus a large part of the book is devoted to a French patent of E. Strasser which includes the periodic system.

Like the previous Patentsammlungen, this is a useful finding list. —H. W. GILLETT.

Current News Items

A.F.A. to Hold Conference in Iowa

The American Foundrymen's Association in cooperation with the State University of Iowa and the Quad City Chapter of A.F.A. will hold a two-day conference at the University, Iowa City, Oct. 29 and 30. This is the second annual foundry conference devoted to various phases of foundry practice. The committee of the Quad City Chapter which has developed a program in cooperation with A. V. O'Brien, State University, consists of T. J. Frank, Frank Foundries Corp., Moline, Ill.; Horace Deane and E. A. Gullberg, Deere & Co., Moline, Ill.

Registration headquarters and all meetings will center at the Engineering Building on the University Campus. The opening session will be at 9:30 A.M., Friday, Oct. 29, when those attending the conference will be greeted by Dean F. M. Dawson, College of Engineering. P. T. Bancroft, chairman of the Quad City Chapter, Moline, Ill., will preside. Friday morning program will be devoted to the discussion of sand.

The afternoon session will cover testing and melting in various phases. Dinner will be held at 7:00 P.M. in the Iowa Student Union Building at which H. O. Croft, head of the department of mechanical engineering, will preside as toastmaster. Principal addresses will be given by Eugene Gilmore, president of the University of Iowa and H. Bornstein, Deere & Co., and president of the American Foundrymen's Association.

Sessions Saturday morning will be devoted to nonferrous matters and to alloy cast iron. The afternoon is left free for inspection of the Engineering Buildings, golf and recreations.

Carboloy and the Tungsten Market

Because of the present world situation and the noticeable effect it has had on the supply and price of tungsten, a recent announcement by W. G. Robbins, president of Carboloy Co., Inc., Detroit, manufacturers of Carboloy cemented carbide cutting tools, dies, etc., is of particular interest at this time to users of cemented carbides. The announcement, which was in the form of a letter released to the metal working trade, is partly as follows:

> As you no doubt know, tungsten carbide is the main ingredient of Carboloy. Because of the uncertainty in connection with the continuation of an adequate supply of tungsten of the proper purity from China, the General Electric Co., during the past few years, has purchased two tungsten mines in the United States. The material from both of these mines is of the high purity demanded for Carboloy requirements.
>
> At the moment, shipments of Chinese concentrates have been suspended and the price of tungsten has risen rapidly. However, the General Electric Co. assures the Carboloy Co.—its subsidiary—that an adequate supply of tungsten will be available from the operation of the domestic mines, to satisfy all Carboloy needs.
>
> Notwithstanding the increase in the market price of tungsten, we have every reason to believe that the price of cemented carbide manufactured by the Carboloy Company will not be increased as a result of this condition.

Users of cemented carbides should find this of unusual interest in view of the many anticipated and actual raises in prices of materials, such as tool steels, dies, etc., having tungsten as an ingredient.

● The Salem Engineering Co. has established main offices in Salem, Ohio, in a newly purchased building, located at 714 S. Broadway. The building has been reconditioned and will be occupied by the engineering staff, from which office the activities of the foreign offices in London, England, and Welland, Ont., and domestic offices located in New York and Pittsburgh, will be directed.

First New Blast Furnace Since 1928

The first new blast furnace to be completed in the United States since 1930, when the International Harvester Co. built a new one on the site of an old one in South Chicago, has been put in blast at Hamilton, Ohio, by the Hamilton Coke & Iron Co., wholly-owned subsidiary of the American Rolling Mill Co. Technically the International Harvester furnace did not count as a new one since it merely replaced one that was torn down, so barring this one stack the Hamilton installation is the first new furnace built in the United States since 1928.

This new furnace, which is designated as Hamilton No. 2, has a daily capacity of 500 tons. The output will be marketed among foundries and steel companies in the Hamilton territory. Hamilton No. 1 furnace was rebuilt a year ago and its daily capacity increased to 700 tons. Output of No. 1 furnace is used in the open hearths of the American Rolling Mill Co., at Middletown, a few miles away, the hot metal being transported in specially designed cars.

With the addition of the new unit, the total number of available blast furnaces is 239, according to *The Iron Age*.

International Acetylene Association to Meet in Birmingham

The International Acetylene Association will hold its 38th annual convention in Birmingham, Ala., Nov. 10, 11, and 12. This will be the first time that the convention has been held in Birmingham. Headquarters for the convention will be the Hotel Tutwiler.

Technical sessions will be held each afternoon. Special sessions of unusual interest, the details of which will be announced at a later date, are being planned for the evenings. The oxy-acetylene process for welding and cutting metals will be featured at all these sessions. As a result of a year of unusual development, a series of vitally interesting subjects will be discussed by speakers who are key men in their fields. Gross attendance at last year's annual convention, held in St. Louis, totaled over 3,100 members and guests.

New Research Associates at Battelle

Battelle Memorial Institute has announced the appointment of four Research Associates for the year 1937-8. Russell H. Lauderdale, metallurgical engineer, University of Minnesota, has received an appointment as research associate in physical metallurgy, to study certain phenomena in the grain growth characteristics of steel; Carl R. Bloomquist, M.S., University of North Dakota, will study fundamental problems involving the heats of wetting at solid-liquid interfaces as an associate in the ore concentration division; Robert P. Graham, M.S., University of Washington, has been reappointed for a second year as research associate in ceramics where he will continue the study of base exchange phenomena and John E. Dorn, Ph.D., University of Minnesota, has also been reappointed to continue studies of the solid solubilities of metals and alloys as research associate in physical metallurgy.

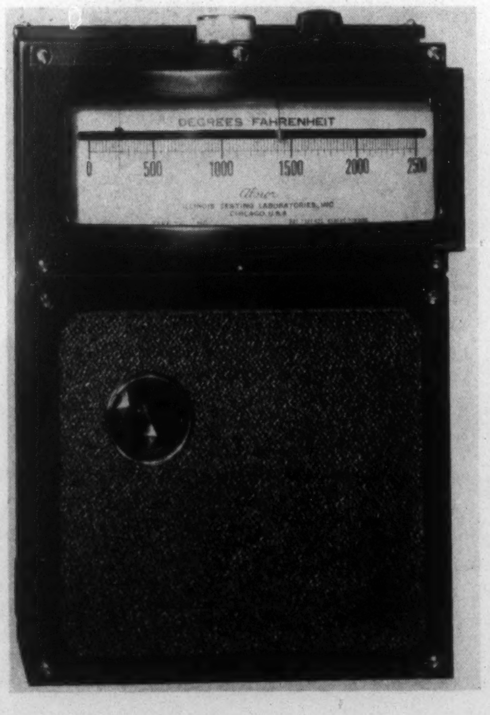
● G. A. Ledebur, 50 North Ave., Washington, Pa., has been appointed representative of the Ajax Electric Co., Inc., in the Western New York and Western Pennsylvania territory.

New Equipment and Materials

"Alnor" Pyrometer Controller

The "Alnor" Pyrometer Controller, (U. S. Patent No. 1,861,929, June 7, 1932, others pending), is offered by the Illinois Testing Laboratories, Inc., Chicago, for those who desire to automatically control temperatures of heat-treating furnaces, melting pots, or other heating devices at a definite pre-determined point. The principle of operation is electronic, similar to a radio circuit. The pointer of the indicating pyrometer carries a small vane. An adjustable target is provided which carries two condenser plates or vanes. These vanes are the capacitive element of a tuned circuit.

Except at the point when the temperature indicating pointer and the target coincide the circuit is unchanged. When the temperature pointer with its vane approaches the temperature setting, the vanes of the pointer and target interleave and produce a circuit change which in turn operates a relay. The heating current if electric is shut off or in case of the fuel-fired operation, the fuel valve is closed partially or completely depending on the type of valve used. There is neither motor nor depressor bar used in the Alnor Controller nor is there any direct contact between the vanes. The temperature indicating pointer is free to give continuous indication and control. A red bull's eye indicates whether the heat in the furnace is on or off.



All circuit elements are operated considerably under the rating to insure against early deterioration and breakdown. The vacuum tube voltages are kept well below the manufacturers' limits to give extended life. Should tube burnout occur, the furnace is automatically shut off insuring against furnace overheating. Vacuum tubes are easily replaced. Stock tubes as sold by radio tube dealers may be used. An exchange or replacement of tubes does not always necessitate re-tuning of the instrument.

Manufacturers are invited to send to the Editor items which are suitable for this department. Illustrations are acceptable, preferably in the form of cuts no more than 2 in. wide.

The terminal binding posts are conveniently located. Removal of the front cover plate of controller housing exposes all binding posts, for easy wiring. Knock out openings at both sides and bottom are provided. All parts of the controller are removable from the point or top without disturbing the instrument mounting from the switchboard or wall.

For electric furnace operation, metallic mercury switches are provided. These are strong, durable and practically non-breakable. Positive make and break contact is obtained in an interval of as little as 3½° tilt. Mercury tubes are available in sizes up to 35 amps at 110 volts A.C. For higher amperages a separate circuit breaker is necessary.

For fuel fired applications, a suitable valve must be used which can be either of the solenoid or motorized type as desired or necessary for the requirement.

The pyrometer indicator of the Alnor Controller is the well known and extensively used Type 2860 Horizontal Edgewise.

Its movement is the same as that which has made "Alnor" so universally known for over 15 yrs. for their accuracy and dependability. It has unusually high torque for its high internal resistance. It is double pivoted with two highest quality jewel bearings. Its 6-in. mirrored scale provides ease of reading. An automatic cold end compensator of the spiral type is furnished as standard equipment.

Single Glass Super Opaque Sheet Iron Cover Coat

Recognizing the need for a better super opaque frit required in one coat enameling, The Porcelain Enamel & Mfg. Co. of Baltimore has developed a radically different single glass super opaque sheet iron cover coat, which offers qualities never before found in a super opaque frit, it is claimed.

The new frit, designated as No. 2117, has been subjected to exhaustive tests in all types of enameling plants. Used without blending with other enamels, the new cover coat showed the highest tear resistance and the highest opacity of any enamel used, according to the announcement. In no case was there evidence of tendencies to curl, sag or slide. Laboratory tests show 76.5% reflectance at 65 grams with 7% clay and no opacifier. An addition of 4% tin oxide will increase reflectance 2½%.

The material is economical. It does not have to be blended with other frits to produce its tear resistance qualities and general workability. No opacifier additions to the mill are required.

According to the manufacturers, the new frit, smelted by the exclusive Pemco continuous process, produces a very high gloss, and because of its broad working qualities, remarkable set and wide firing range, it readily falls in line with various plant conditions. Warping is reduced to a minimum because it can be fired at a comparatively low temperature.

Heavy Duty Lighting Unit

Designed to provide and sustain maximum light output under severest service and atmospheric conditions, the new "Millite" lighting units have been announced by the Westinghouse Electric & Mfg. Co. They are especially suitable for use in steel mills, foundries, cement plants, chemical plants, forge shops and similar heavy industry applications where moisture, smoke, dust, dirt, acid fumes or general hard use preclude the use of ordinary open type high bay units.

The Millite is dust tight and vapor proof which makes it simple to clean and easily maintained. The reflector is treated by the Alzak process which retains its high efficiency permanently. There are no louvres or vents to cause a flue action which might deposit a film on the reflector and thus impair the efficiency of the unit.

The complete Millite unit consists of a steel housing, a specular or diffuse removable reflector, and a hinged glass cover. The unit is arranged for ½-in. conduit mounting but can be furnished for ¾-in. conduit. They are designed for use with 750 watt, 1000 watt or 1500 watt lamps.

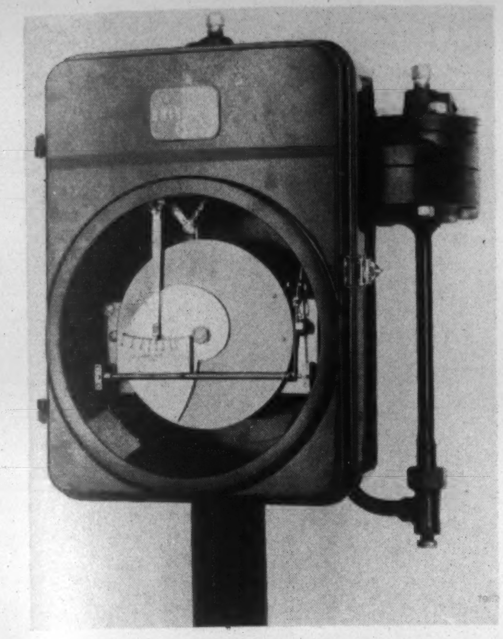
The reflector is spun from 14 gage aluminum sheet. The reflecting surface for medium mounting units is semi-specular finished; for high mounting units specular finished. Both semi-specular and specular reflectors are treated by the Alzak process for higher efficiency and permanence. In addition, the outside surface is finished with special acid-resisting high-bake, multi-coat green enamel.

A one-piece steel housing drawn from 20 gage steel sheet completely encloses the aluminum reflector and protects it from impact damage. The steel housing is finished inside and out with special acid-resisting high-bake, multi-coat green enamel.

The cast aluminum ring is permanently hinged to the steel housing and locks in place by three cadmium plated, malleable iron hook bolts. The locking arrangement permits the glass cover door to be opened or closed without the use of any tools. The cast aluminum ring is finished with special acid-resisting high-bake, multi-coat green enamel.

A New Electric Flow Meter

For measuring the flow of steam, liquids and gases through a closed line, and transmitting the reading to a point remote from that of measurement, a new "Electric Flow Meter" has been developed by The Bristol Co., Waterbury, Conn. These instruments have been added to

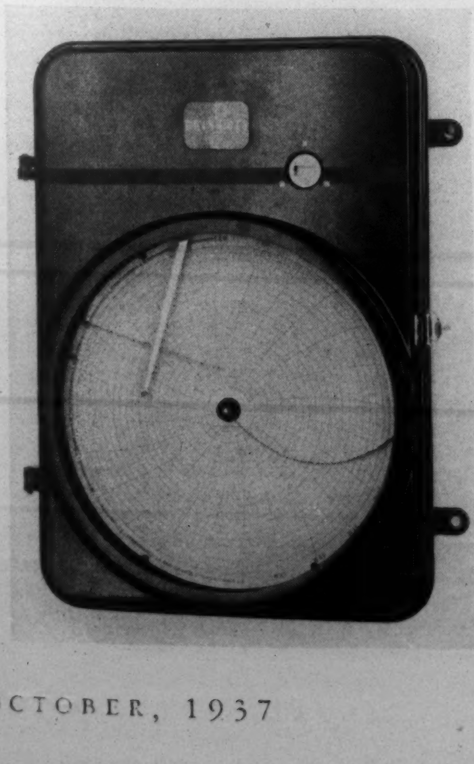


a complete line of mechanical flow recorders and controllers, manufactured by this company for a number of years. The new Electric Flow Meter operates on Bristol's Metameter principle of telemetering and consists of the following instruments.

The Transmitter, which measures accurately, by means of a mercury manometer, the differential pressure across an orifice plate, venturi tube or flow nozzle, located in the line through which the medium under measurement passes. A specially designed cam is used to extract the square root of the differential pressure readings and to transmit them in the form of electrical impulses over a two-wire electric circuit to the receiver, where they are recorded on an even scale chart.

The Receiver, which is located at a distance from the Transmitter—several hundred feet or many miles—where the operator or superintendent may observe the readings on an even scale chart or indicating scale. The receiver is also equipped with an electric integrator, which indicates the total flow on an index counter. The difference between the reading of the counter at the beginning and end of a definite interval, when multiplied by the total integrator constant stamped on the integrator plate, gives the total flow for the time interval.

The transmitter and receiver of Bristol's Electric Flow Meter are connected together electrically through a two-wire circuit. By means of special devices in both instruments, the readings are transformed into electrical impulses, which propel the pen arm or indicator of the receiver up or down the scale in exact proportion to changes that occur at the point of measurement.

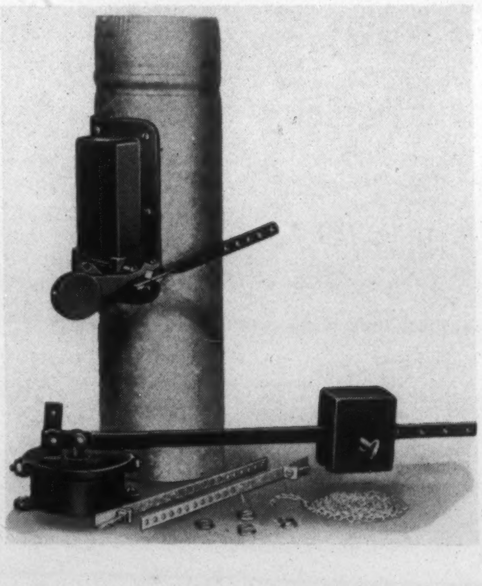


The Electric Integrator is a new feature of Bristol's Flow Meters—both the electrical and mechanical types. A flat disc cam, specially designed to coincide with the flow law, is used to mechanically compute the square root of the differential pressure being measured. The values obtained are totalized by means of a counter and are indicated on a 6-figure integrator dial. The integrating mechanism consists essentially of a continuously running telechron motor, which operates a counter through a train of gears. These are engaged and released by means of a mercury switch and magnet as the cam rider is engaged and released. While the telechron motor runs continuously, it operates the totalizer counter only when the gears through the integrator are meshed.

Bristol's Electric Flow Meter instrument cases are of aluminum alloy, of moisture-, fume-, and dust-proof construction. The transmitter is approximately 13 in. by 10 in. by 5 in., and the receiver, 18 in. by 13 in. by 5 in. The receiver is available for wall or flush panel mounting.

Surface Tank Regulator

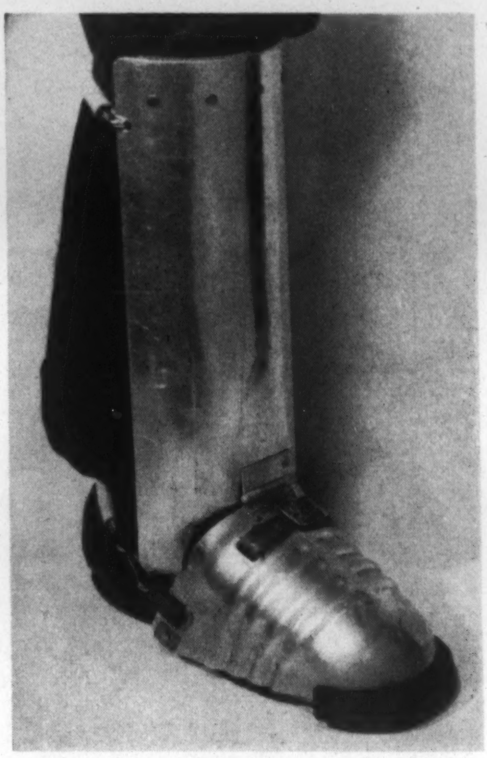
A new arrival to the National line of automatic controls is the Type M508 "Surface Tank Regulator" for coal or coke fired installations. This instrument is one of the first to be released by the National Regulator Division of the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., formerly known as the National Regulator Co. of Chicago. The National Surface Tank Regulator incorporates all the superior features known to this type of control in addition to several new features of its own. The construction of the regulator body provides for better contact with the pipe or tank to which it is attached, which in turn provides for quicker action of the regulator with better modulation of the damper.



The National Surface Tank Regulator may be mounted on a vertical line of pipe, a horizontal line of pipe or on the hot water tank itself. The advantages of this regulator arise to a large etxent from the unusual design of the "Metaphram", the National trade name for an individual diaphragm. This diaphragm is constructed of the highest grade "Admiralty" brass which is not heated or spun in the manufacturing process, thus retaining the full resiliency and strength of the brass. Three of these "Metaphram diaphragms are included in the National Surface Tank Regulator to provide greater sensitivity, more movement and more power. Tank heaters, controlled by one of these regulators, assure a constant supply of hot water at any desired temperature and prevent fuel waste. This regulator saves its cost many times over by preventing plumbing bills due to damage to faucets and fixtures from boiling water. The regulator is offered complete with one 3-lb. weight, a 17¼ in. lever, damper chain "S" hooks and straps for mounting purposes. It is also available with a section of pipe and damper. The finish of the regulator is black.

Sankey Aluminum Alloy Shin Guard

The Ellwood Safety Appliance Co., 201 Fountain Ave., Ellwood City, Pa., announces the development of an aluminum-alloy Shin Guard, which is marketed attached to their Sankey "Improved" Foot Guard, incorporating silent toe piece and quick fastening attachments. This unit affords leg and foot protection against hazards such as found in foundry operations, logging and timber activities, and in manufacturing processes requiring protection of this kind. The complete guard, with foot protection, is furnished as illustrated, easily put on without special adjustment, comfortable to wear, and permits free foot and leg action on the part of the worker.



McKay Co. to Make Electrodes

The McKay Co., Pittsburgh, known for its outstanding success in the manufacture of tire chains and industrial chains and in recent years for its output of highly modern metal furniture, has announced the establishment of a new division for the making of shield-arc welding electrodes. Itself one of the world's largest users of electric welding and its processes, the company is thus only extending its activities in a field to which it brings a fund of practical experience.

In connection with its large electric welding operations at York, Pa., an extensive new plant has been built, equipped, and put into production. The most advanced machinery and methods for the manufacture of welding rod are used, including some never employed elsewhere. A wide range of types and sizes of rod will be produced under conditions that assure highest quality through uniform control and high precision of product for all the needs of the newer welding practice.

The McKay technical staff has been at work for over two years in developing the formulas and procedures by which coatings are made and applied to McKay rods, and the aid of a leading independent research staff is being used to supplement such efforts.

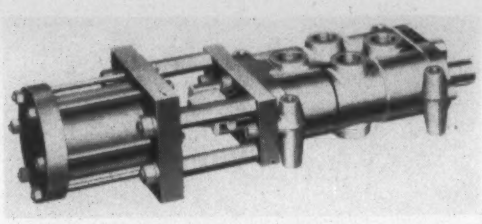
L. E. Faulkner, widely experienced in the science of electric welding, is chief chemist for the new McKay plant. M. J. Van Dreser, who also has been prominently associated with the welding industry, is sales engineer in charge of the McKay electrode sales and service staff. T. J. McKay, Jr., is responsible for sales promotion and the coordination of engineering and plant activities with sales demands.

Bronze Forged Pilot Operated Hydraulic Valve

The design of this new valve embodies the same no metal-to-metal wear principle and minimum of moving parts as characterizes this line of "Quick-As-Wink" air control valves, manufactured by C. B. Hunt & Son's Co., of Salem, Ohio.

The illustration shows a bronze forged housing valve pilot operated, for 4-way operation; also built for 2-way and 3-way. It is made in ½, ¾ and 1 in. sizes, in two styles, for 1000 lbs. working pressure and for 2000 lbs. working pressure. The bronze forgings used as housings are among the largest bronze forgings ever made. The employment of the dropped forge bronze housing with its high physical strength affords an additional factor for long life with water and corrosive fluids.

"In the "Quick-As-Wink valving principle, the valving operation is accomplished in the 2-way valves by only one moving part; in the 3-way and 4-way valves by coincident motion of the two valve bodies or plungers. The valve bodies or plungers are made of stainless steel. These are "free-floating" in special packings, avoiding metal-to-metal contact. Balanced port action in conjunction with the valving ring and the no metal-to-metal contact, is claimed to provide a combination for extremely long life and satisfactory performance in hard service. Short travel is an aid to easy operation. Accessibility is such that complete inspection, replacements of parts and reassembly can be made in a few minutes without disturbing the hydraulic piping. Connections are provided so that the piping may be permanently connected above or below housing. The only internal moving parts, the stainless steel valve bodies or plungers in several years of hard continuous service have shown imperceptible wear due to valving action, in millions of operations.



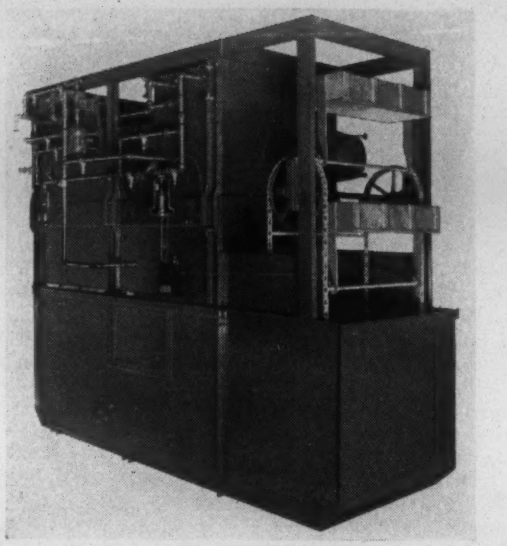
A complete new catalog, "Quick-As-Wink" Air and Hydraulic Control Valves, is now on the press and will soon be available.

Automatic Vapor-Spray-Vapor Detrex Degreaser

The complete line of standard and special decreasing machines manufactured by the Detroit Rex Products Co. of Detroit, has been augmented by a large, completely automatic degreaser. It is used for the cleaning of miscellaneous metal stampings.

This special vapor-spray-vapor machine is equipped with a two-strand, cross-rod type conveyor arranged for loading and unloading at the same end. The work is placed in perforated baskets which are hung from the cross-rods of the conveyor. In passing through the degreaser, work is lowered into the hot solvent vapors which thoroughly wet the work and remove part of the heavy contamination. As the conveyor moves horizontally along the machine beneath the water jacket condenser, clean warm solvent is pressure-sprayed onto the work from banks of spray nozzles. This mechanical action forcibly removes and drives off the solids. A final cleaning in pure solvent vapors insures complete removal of oil and grease. Returning back overhead to the loading and unloading station, the work emerges clean, warm, and dry —ready for subsequent finishing operations.

Steam coils are placed in the boiling sump and in the clean solvent distillate collecting sump. Galvanized steam coils are welded to removable clean-out doors. A vapor-actuated, air-operated control system, consisting of thermostat temperature indicator and valve, is used to regulate the heat input, control the height of the vapor column, and insure maximum operating economy. A self-actuated valve in the steam line which heats the clean solvent distillate controls the temperature of the hot solvent used for spraying.



A water jacket condenser and a solvent collecting trough encircles the machine. The collecting trough is arranged so that the clean distillate can be made to flow into the spray sump at the right end of the degreaser or into the clean solvent storage tank at the back of the machine. The solvent that drains from the work, as well as the over-flow from the clean solvent spray sump, flows back into the boiling sump.

The clean solvent storage tank is of sufficient capacity to hold all of the solvent from the machine during the distilling operation. In this way, the contamination is removed and the solvent reclaimed for further use by distillation within the machine itself.

The rated production cleaning capacity of the degreaser shown in Fig. 1 is approximately 3000 lbs. of work per hour at a normal conveyor speed of 6 ft. per min. The conveyor speeds can be increased to 12 ft. giving 6000 lbs. produced per hr. The overall dimensions of this unit are approximately 13 ft. long, 7 ft. wide, and 11 ft. high. The solvent capacity is only 120 gallons.

New Portable Pyrometer

A new millivoltmeter-type portable indicating pyrometer is now being offered by The Bristol Co., Waterbury, Conn., for measuring temperatures up to 3000 deg. F., using a thermocouple and extension leads.

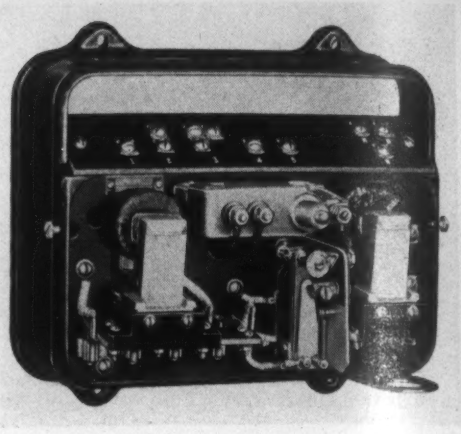
Use of a cobalt magnet allows exceptional design features—including increased sensitivity and a widened scale for more accurate readings. Unusual sensitivity is accomplished without the need for critical leveling adjustments and with no sacrifice of ruggedness. The high-resistance millivoltmeter movement is double-pivoted and completely shielded to prevent the effects of stray fields.

The molded Bakelite case is of moisture- and dust-proof construction, and of modern design. The instrument is available in single and in double ranges. It is especially adapted for industrial use.

Industrial Oil Burner Control

In answer to the constantly growing demand for an industrial oil burner control system that will give a timed sequence of the burner's operation the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., has developed and released the Type R157A "Protectorelay". This Protectorelay permits predetermined ignition timing, delayed opening of the oil valve, if required, and timed scavenger or recycling period. It incorporates the basic "Series 10" circuit using one line voltage and one low voltage relay. One time switch is utilized for both ignition and oil valve as well as providing a timed delayed return to the cold position.

The Type R157A Protectorelay is offered for use with the Type C56 Pyrostat, mounted in the stack or breeching, to provide safe operation of the burner. This 3-wire Minneapolis-Honeywell safety control overlaps on the heating cycle but not on the cooling cycle. The ignition switch timing is adjustable from 45 to 120 sec. with a factory setting of 120 sec.. The delayed oil valve timing is approximately 25 to 35 sec., and the safety switch timing is approximately 80 to 100 sec. Current rating is 10 amps. at 110 volts and 5 amps. at 220 volts with a motor rating of 1 hp. repulsion induction and ½ hp. split phase. The Type R157A Protectorelay is finished in black Kristo Krak and is approximately 7½ in. high and 7⅞ in. wide.



Device for Handling Scrap Iron

In perfecting a new type of grapple with independent action of its tines, The Owen Bucket Co., of Cleveland, has developed a revolutionary method of handling scrap iron. In actual comparative tests recently made in Milwaukee, the "Owen Grapple" outperformed a 55 in. magnet, showing a marked increase in weight per lift and tonnage per hour as compared to the magnet.

In addition to handling greatly increased tonnage of various kinds of commercial scrap iron, the Owen Grapple is said to be very efficient in handling pigs of non-magnetic spiegel iron, which is usually a slow and costly, hard hand job. In one case an Owen Grapple loaded a car with 65 tons of this ore in 25 min. The independent operation of the tines enables the Owen Grapple to easily penetrate various kinds of scrap and to gather and lift large capacity grabs.

In closing, the tine which encounters the least resistance penetrates deeply into the material and anchors. The other three tines follow in the same order with a powerful gathering, closing action like that of a giant hand. Small scrap, bushelings and stove plate are picked up in grabs so large that the grapple is far from closed and there still is no spillage after the grapple has compressed these materials between its tines. Properly operated it will loosen larger pieces of matted material and pull them out individually when necessary.

The comparatively low first cost, the reduction of operating expense and the exceptionally large handling capacity make the Type RA Grapple an attractive item for anyone in the scrap handling field.

Selective Hardening Treatment with Oxyacetylene

A new process of selective hardening by heat treatment, which is both novel and effective, is announced by the Air Reduction Sales Co., 60 East 42nd St., New York. It is called the "Airco Process of Flame Hardening," in which the oxyacetylene and water play the leading roles. Briefly, by means of special apparatus, the metal to be hardened is heated with the oxyacetylene flame and almost simultaneously quenched with water. Some of the principal features of this method and apparatus, as described by the company, are as follows:

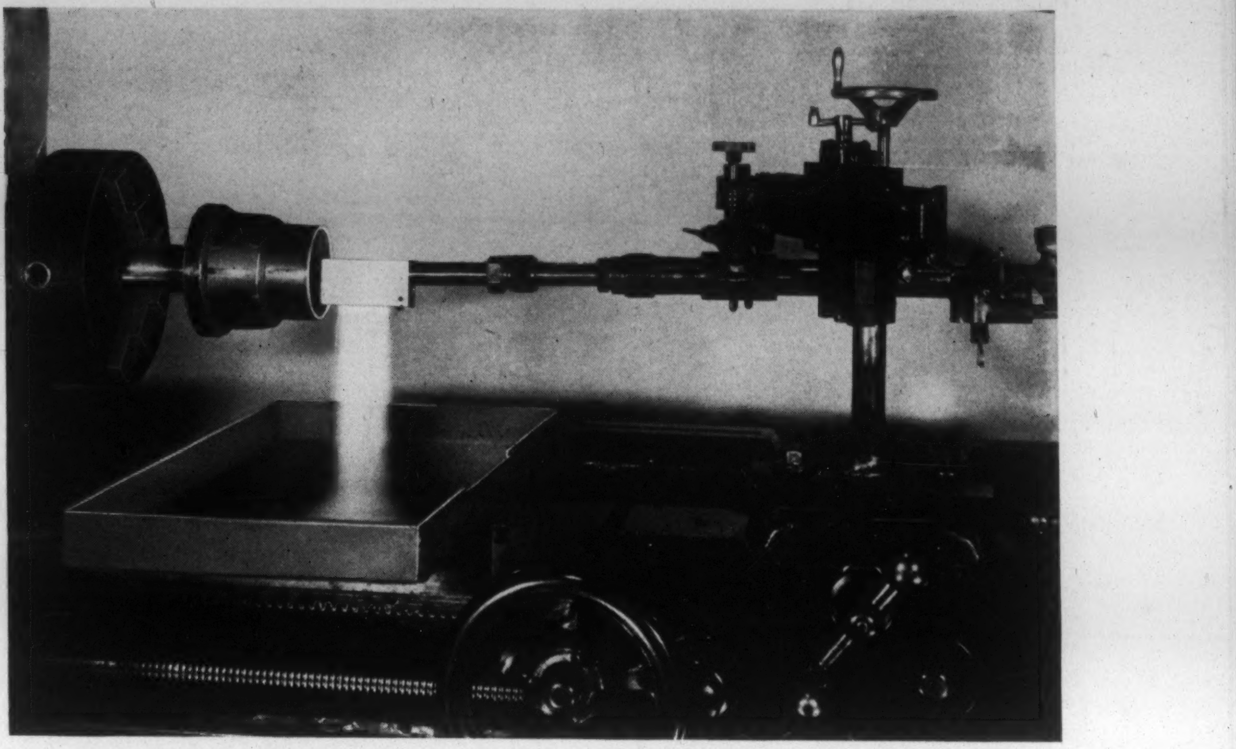
Hardening with the oxyacetylene flames consists simply in heating the wearing surfaces of a machine part above the critical temperature by means of the oxyacetylene flame and cooling with a suitable quenching agent, generally water or compressed air. The hardening effect obtainable is similar to furnace hardening practice provided that in both cases the material has been heated to the same temperature and that similar rates of quenching are employed. The hardness can be tempered where required as in furnace practice by a second and more gentle heating. The depth of flame hardness produced generally varies from ⅛ to ¼ in., corresponding in penetration with the case hardening process and can be rigidly controlled. In special applications, the hardness penetration can be much less than ⅛ in. and as deep as 1 in. as required, and depending on the hardenability factor of the steel.

Plain carbon steels above 0.35% carbon are readily hardened. The standard S.A.E. low alloy steels containing manganese, chromium, nickel and silicon in concentrations from 0.50 to 2.0%, can be appreciably hardened with carbon content as low as 0.25%. Increasing carbon content favors hardness obtainable. Rail steels containing .80% carbon are flame hardened from a Brinell of 220 to 450 using a very mild quench: Rapid quenching of such steels yields hardness at the limit of the hardness scale, 700 Brinell, equivalent to the hardness of common hardfacing materials. Such extreme hardness can only be used on applications free from shock.

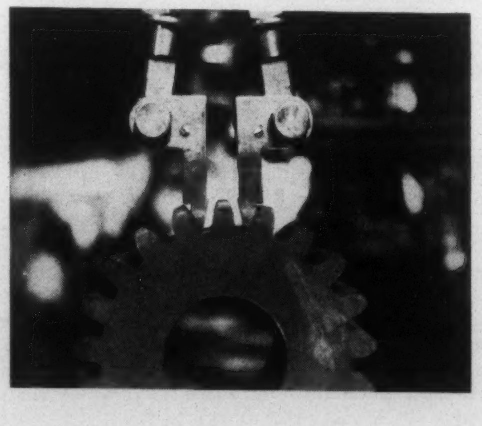
The S.A.E. low allow steels with carbon at 0.35% can be hardened to 500 Brinell with a moderately rapid quench. In hardening high carbon steels in the tool steel range, care must be exercised to avoid surface cracks or checks either from a too rapid application of heat or a too severe quench. Certain semi-steels and low alloy cast irons common to machine construction can be flame hardened. In general, their hardening procedure is not as well developed as in the case of steels and may require some experimentation to determine the proper rates of heating and quenching. For many machine parts, air hardening steels can be used, which require no quenching to obtain hardness after heating.

Flame hardening can be accomplished either manually or mechanically. Where limited areas of a part are to be treated, the area can be heated above the critical temperature by application of the standard welding torch, the entire area being brought to heat by manipulating the torch back and forth across the surface. The torch is then removed and the surface quenched with water, oil or compressed air as required. Extensive use is made of this process in hardening rail ends to reduce batter. In hardening extended areas such as the entire rail length, the hardening process is made continuous by incorporating both heating and quenching functions in the hardening tip, and providing means for moving the tip at a constant speed along the path to be hardened. Heating is accomplished by one or more rows of small oxyacetylene flames followed closely by a row of quenching holes.

The tip progressively heats the surface along the path of travel to hardening temperature and the quenching stream following imparts a uniform hardness to the area covered by the tip travel. Multiflame tips must be water cooled to prevent overheating and flash back of the heating flames. Tips 5 in. in width have been made for hardening wide areas, but it is usually more practical to use narrower tips, 3 in. in width and under, and to harden the surface in successive strips. Auxiliary water jets are applied at the ends of the rows of heating holes to prevent flow of heat into the areas already hardened. The soft line between two successive passes can be made so fine that it cannot be detected with the standard Brinell tester. The speed of tip travel will vary from 3-12 in. per min. depending on the size and number of heating holes and determines the penetration of the hardness. The degree of hardness obtained is regulated by the nature and volume of the quenching stream.

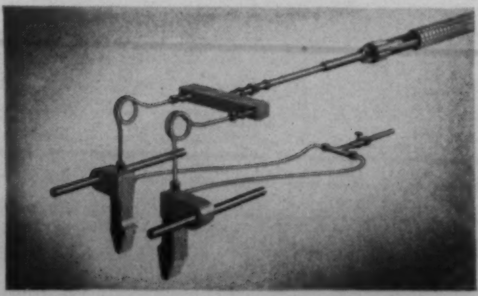


To provide for accurately controlled speed of motion of the hardening tip over the object surface, the torch can be mounted on a standard Airco-DB cutting machine, the No. 4 Radiagraph. The tool post of a lathe with variable feed can also be used as a torch holder.



Cylindrical surfaces are hardened by mounting the object on the spindle of a lathe and fixing the torch in the lathe tool post. The peripheral speed of the surface to be hardened should be similar to the speed of travel over flat surfaces given above. Both internal and external surfaces of a cylindrical object can be thus hardened.

In hardening the internal surface of a cylindrical object of shallow depth, use is made of circular heating tips, which heat the entire surface as in rail end hardening. Cylindrical shafts of extended length are hardened by rotating the shaft on a lathe spindle with the torch mounted in the tool post. The torch is fed slowly along the length of the shaft, the relative motion of the hardening tip being spiral to the shaft axis. As in hardening successive flat strips, auxiliary quenching streams are used to avoid drawing the hardness of areas already treated.



Flame hardening tips can be supplied to fit irregular contours. In many cases, however, it is preferable to split up such a contour into several parts, and harden each part of the contour as a separate operation. The resulting simplifications in tip design considerably reduce their cost and promote easy operation.

In hardening gear teeth, the tooth profile is divided into two parts and heating tips are designed to fit each half of the tooth contour. Spur, sprocket, worm and herringbone gears are hardened by mounting the tips in a yoke at a fixed distance apart and providing for uniform motion of the tips along the tooth. Special equipment is required in the case of worm and herringbone gears to rotate the gears as the tips move in a straight line along the gear axis, and with bevel gears for varying the spacing of the hardening tips and the speed of torch travel to accommodate the varying cross section of the tooth.

Depth of hardness is governed by the amount of heat put into the object and is controlled by adjusting the speed of torch travel, and the volume of oxygen and acetylene supplied to the tip. The degree of hardness obtained depends on the rate of quenching, and is governed by the type of quenching medium, water, compressed air, etc., and by the volume of quench used. Simple trials easily determine the correct settings of torch speed, gas flow and rate of quenching to produce any degree of hardness and depth of penetration desired.

The three illustrations show the apparatus itself, how it is applied to the hardening of gear teeth, and also its application to the hardening of the inside of a cylinder where the cylinder is rotated and moved over the flame hardening apparatus.

Protective Coatings

"Mavco Protective Coatings", containing chlorinated rubber and acid and alkali-resistant placticizers, are now offered for the effective protection of plant and equipment against corrosion. Various types are available which are claimed to be moisture, acid and alkali-proof. Practical long range tests have proven the value of these coatings in the effective protection of metal, wood and concrete surfaces against corrosion attacks of acid and alkali vapors and liquids. These products are furnished by the May Products, Inc., Newark, N. J.

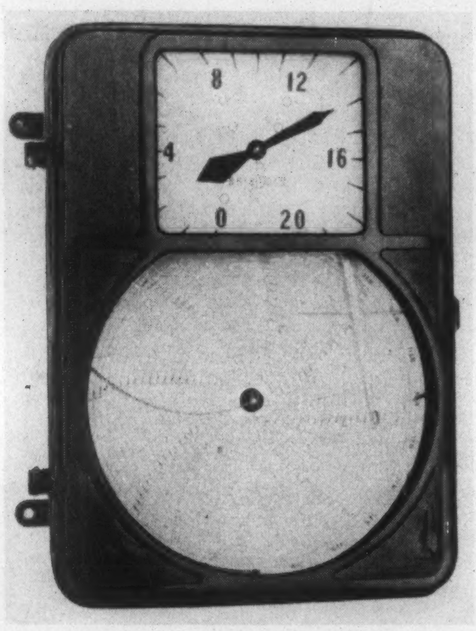
Round-Chart Potentiometer Pyrometer with Dial Indicator

A new potentiometer pyrometer has been recently developed by The Bristol Co., Waterbury, Conn., for recording and indicating thermo-couple temperatures. Bristol's "Indicating Recording Pyromaster," the name applied to the instrument, provides for direct marking on a 12-in. round-chart and scale indication on a large dial. It employs the potentiometer method of measuring electromotive force in terms of temperature, using standard thermocouples and extension leads, but it operates on a new and simplified principle. The new instrument is characterized by the following special features:

1. It is exceedingly rugged—not affected by excessive vibration.

2. There is no mechanical motion of any kind except when a change in temperature occurs.

3. The operating mechanism is simple and compact, consisting of: (1) a highly dampened sensitive galvanometer, ruggedly pivoted in jewel bearings. (2) a special relay unit, actuated by the galvanometer to operate the motor that balances the electromotive force from the thermocouple and positions the recording pen arm and scale indicator, (3) a standardizing unit, (4) a "Power Pack" and (5) the potentiometer or recording and indicating units.



4. The pen arm or indicator is actuated through the relay switches in small steps, at a rate depending upon the rate of change in temperature at the thermocouple.

5. No lubrication is required.

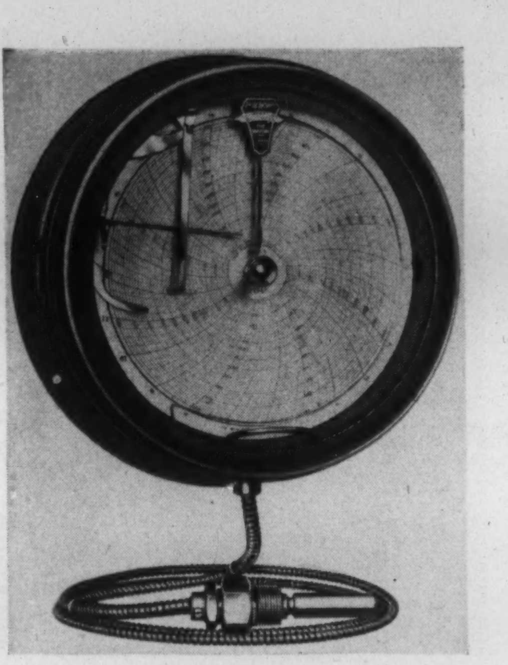
6. The cold-junction compensator is fully automatic. No manual adjustments are necessary.

7. The extreme simplicity of the operating mechanism makes it possible to house the instrument in a standard Bristol's case.

Bristol's Pyromaster is available as a recorder, indicator, recorder with indicating scale, recorder controller, and as a recorder controller with indicating scale. Controllers are of either the pneumatic or electric type. A copy of Bulletin No. 489 describing these instruments may be obtained upon request.

Mono-Therm Thermometers

A modernized line of indicating and recording thermometers, incorporating improvements in design, construction and operating characteristics, is being introduced by The Foxboro Co., Foxboro, Mass. Known as "Mono-therm Thermometers," these instruments employ an improved thermal system which provides a complete permanent seal for the actuating medium. The entire system is either welded or braised in such a way that it becomes an integral piece of metal. This new construction reduces to a minimum any possibility of leaky joints which would affect the accuracy of these instruments. Even in face of mechanical shocks, continued vibration, and overrange temperatures, a tight thermal system is assured. The Mono-therm construction is at present being applied to Foxboro thermometers of the vapor-pressure, gas-filled and liquid-filled types.



All of the Mono-therm recording thermometers are so designed that the charts may be changed easily with one hand. This feature saves a lot of valuable time and effort.

Available with the Mono-therm recording thermometers is a new extra overrange protection. The liquid-filled instrument can be protected against an overrange up to a maximum of 500 deg. F. That is, 250 deg. F. can be protected to 500 deg. F.; 350 deg. F. can be protected to 500 deg. F. Similarly, the gas-filled instrument can be protected against an overrange of 100 per cent up to a maximum of 1000 deg. F. The vapor-pressure type can be protected for a 100 per cent overrange to the breakdown point of the actuating medium.

A wider Bourdon spring and a larger, stronger movement give the vapor-pressure indicating thermometer greater durability and ruggedness. These improvements increase the ability of this instrument to stand rough handling and vibration. The gas-filled recording thermometer also employs a new wide spring which adds greatly to its power.

Further information about the new Monotherm thermometers may be obtained by writing to the Foxboro company. A copy of new bulletin 198-1 describing the recorder will be included upon specific request.

A Baby Portable Airpainting Unit

The most recent or outstanding development in the industrial finishing field is the new "Baby Portable Electric Airpainting Unit" that actually sells for less than one would expect to pay for a good portable typewriter. This comparison is made to emphasize the tremendous sales possibility as there already exists a need for it for maintenance work in small manufacturing plants, hotels, schools and other public institutions as well as automobile refinishing shops and even individuals.

The outfit consists of a 1/6-h.p., electric motor driven aircompressor with airbrush, material cup and hose complete. While the unit is small enough to carry in an ordinary traveling bag, yet it is big enough to paint an automobile, fenders, refrigerators, household and office furniture and appliances as well as small buildings, fences, etc.

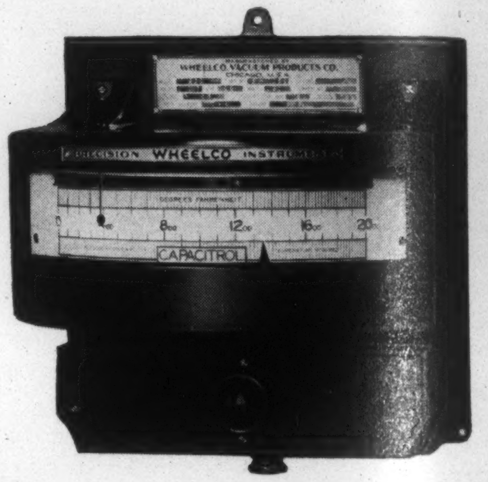
There is no intent on the part of the manufacturers of this equipment to convey the impression that this unit will displace high production equipment, such as is used in the painting of large buildings or for maintenance and production work in large industrial plants. It has a distinct field or market of its own, just the same as the portable typewriter has its own distinctive market. It is by no means a toy, and will readily handle or do a man size paint job and do it in business-like fashion.

The unit will be stocked and sold by jobbers throughout the country and its principal outlet will be through automotive supply dealers and paint dealers, hardware dealers, department stores, etc.

The Wheelco "Proportioning Capacitrol"

The Wheelco "Proportioning Control", Wheelco Instruments Co., 1933 S. Halsted St., Chicago, consists of an electrical device mounted integral with an indicating pyrometer. It is designed to control fuel-fired or electric heating units which cannot be successfully controlled by the simple 2-position or 3-position type of controller. Unlike other types of throttling or proportioning controls, which depend for their action upon complicated mechanical or electric balancing mechanisms, the Wheelco Proportioning Controller operates in conjunction with simple valving or contacting equipment. Where continuously variable fuel input is required to maintain constant temperature, eliminating all overshooting or undershooting, the Proportioning Control is claimed to be the only solution.

It achieves the effect of a continuous input variation by varying the ratio of ON time to OFF time in a time cycle of predetermined length. The length of the cycle has been chosen sufficiently small so that the change in temperature during one time cycle is practically negligible. The Wheelco Proportioning Control provides constant even temperatures regardless of varying heat requirements, overcomes time lag due to slow reaction of furnace temperatures, balances the heat input against the heat required by the work, and all operating functions are entirely electrical. The Proportioning Control operates by the "Radio Principle".

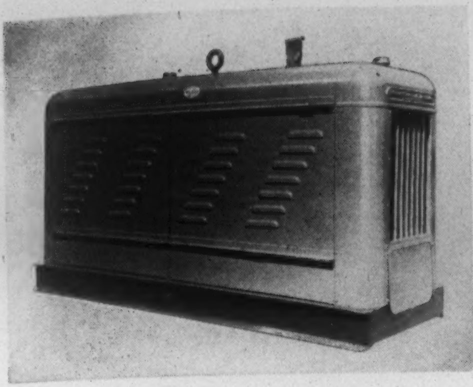


Wilson Yellow Jacket Pipe Line Machine

A new electric welding machine designed exclusively for pipe line work has been announced by the Wilson Welder & Metals Co., Inc., of 60 East 42nd St., New York. It is obtainable in 300 and 400 amp. capacities and is distinguished by its color and the name "Yellow Jacket", and it is claimed to be the most modern and the finest pipe line machine yet produced for this exacting work. The conditions surrounding pipe line welding are such as to very definitely call for welding equipment designed and built expressly for the purpose. With this in mind, the Wilson company has constructed their machine with a ruggedness far beyond that which is needed in less rigorous work. Weather contingencies and circumstances of field operations have been carefully studied and all problems encountered have been taken into consideration in its design.

New features outstanding, which contribute toward the machine's dependability under these extreme conditions, are: Double sediment collectors for carburetor supply; improved foolproof idling device; large 36-gal. capacity gasoline tank; improved current switch. Other features are: Close coupled design; a lowered center of gravity of one foot; light-weight reinforced base and framework; center lifting bail; double-radiator protecting grill.

The distributor and other parts are easily accessible and for operating purposes two hinged panels are placed on each side, thereby permitting instant and easy access to all controls. Optional equipment includes either battery or magneto ignition.

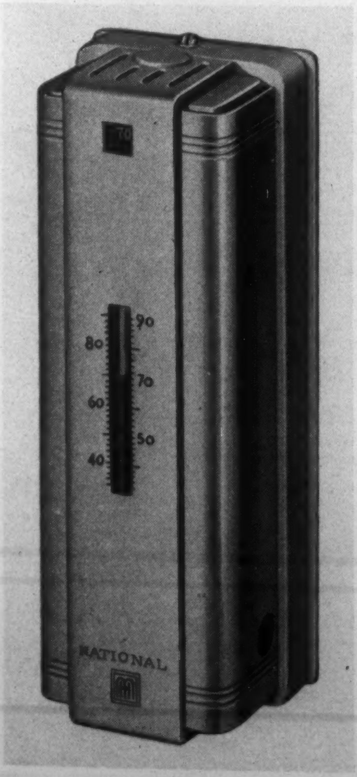


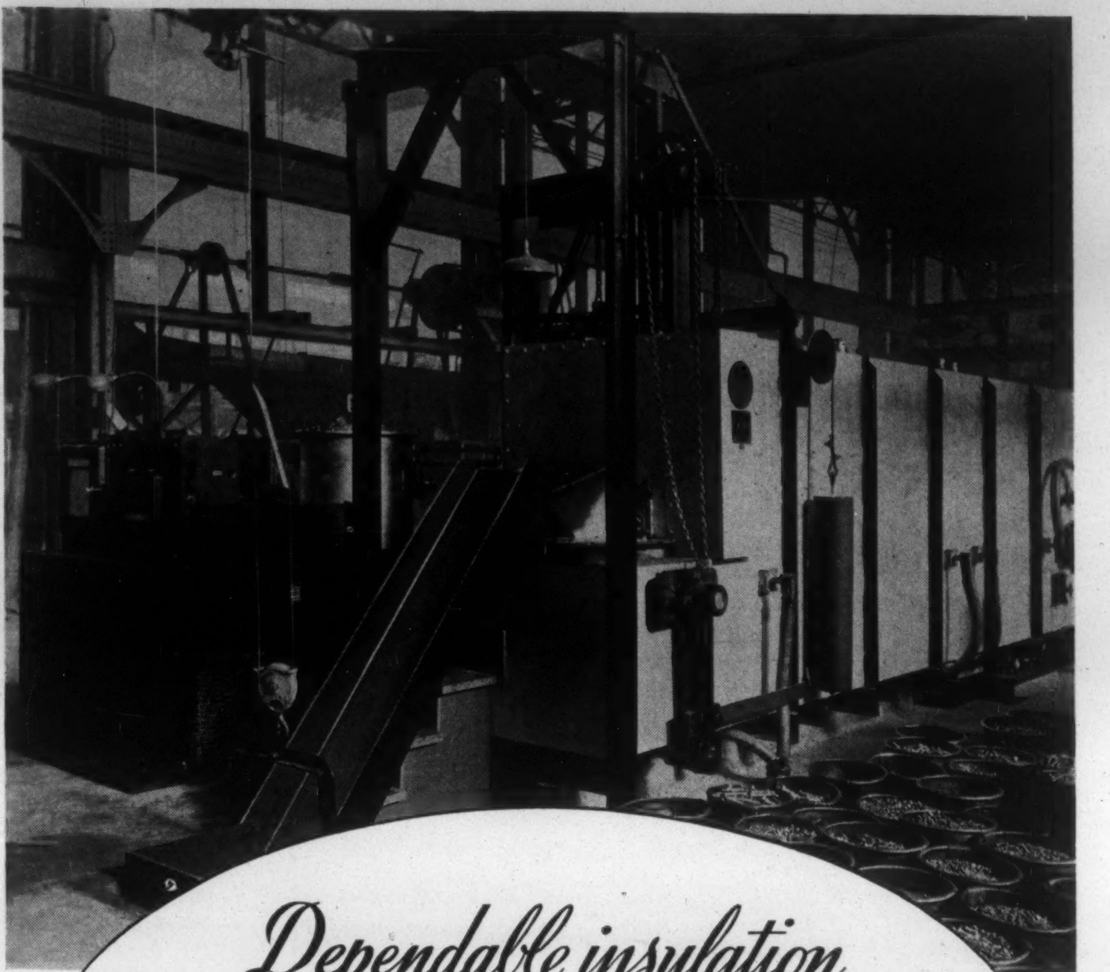
Great interest is being shown by welders who have already come into contact with the "Yellow Jacket". It has successfully completed all tests, and has performed not only in the shop, but on new pipe lines where it operated very satisfactorily under the most trying field conditions.

Pneumatic Thermostats

An important change has just been announced in the National line of pneumatic thermostats as the new National Division of the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., introduced its "Helmet Sealed" thermostat in a new, modern case designed along the lines of other Minneapolis-Honeywell thermostats. This also affects the National line of room type humidity controllers. Although over 35 yrs. of successful installations have established the mechanical arrangements of the National Pneumatic Thermostat as the finest possible, steps have been taken to improve the thermostat's outward appearance in order to harmonize with the modern interior. This instrument is the thermostat with "Helmet Seal" protection.

All moving parts of the National Thermostat operate literally in a sealed chamber which guarantees its trouble-free, dependable operation over an indefinite period, free from the contamination of dirt, chemicals, chalk dust or any foreign substance and free from tampering even to the extent of preventing the disturbing of the operating mechanism by pushing a pencil or any other foreign object through the openings in the case. National's thermostatic element of "Ebonite" has been retained because 35 yrs'. experience has proved the wisdom of this selection. The overall size has been greatly reduced, and the simplified adjustment features of the previous model have been retained. The thermometer has been recessed for protection. The temperature range of the new thermostat has been changed from 35-82 deg. F. to 46-90 deg. F.





Dependable insulation helps control **TIME, TEMPERATURE,** *and* **ATMOSPHERE** *in this furnace for scale-free heat treating*

ACCURATE, uniform, scale-free results are assured in this chain belt conveyor furnace built by The Electric Furnace Company, Salem, Ohio. In its operation, Armstrong's N-16 and EF-22 Insulating Fire Brick help control temperature as well as atmosphere for scale-free heat treating and clean and bright hardening. These efficient brick assure more uniform temperatures, lower fuel costs, and increased production in furnaces and heating equipment of all types.

Low conductivity has been the first consideration in the manufacture of Armstrong's entire line of Insulating Fire Brick. And the extremely high crushing strength of these brick make them suitable for any type of design without sacrificing thermal efficiency. Furthermore, each brick is ideally adapted for the service recommended. Light in weight, structurally strong, their high insulating efficiency is due to the fine cellular composition which is produced by burning out finely ground cork particles.

Armstrong's complete line of Insulating Fire Brick includes five types. Armstrong's N-16, N-20, and A-25, are *light duty* brick for temperatures up to 1600°, 2000°, and 2500° F., respectively. They are generally used as a backing up brick, but may also be used as a refractory lining when heavy service is not required. Armstrong's EF-22 and EF-26 are *heavy duty* brick and may be used in direct exposure for temperatures up to 2200° and 2600° F., respectively. For full information, samples, and prices, write Armstrong Cork Products Co., Building Materials Div., 982 Concord St., Lancaster, Pennsylvania.

Armstrong's

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